WIRE AND WIRE PRODUCTS

OCTOBER 1943

SEE THE COMPLETE LINE OF VAUGHN WIRE DRAWING MACHINES, DETAILED ON PAGES 596 ABCD, THIS ISSUE!

BASIC
IN WAR WIRE PRODUCTION

Vaughan

MOTOBLOC
& MOTOBLOX

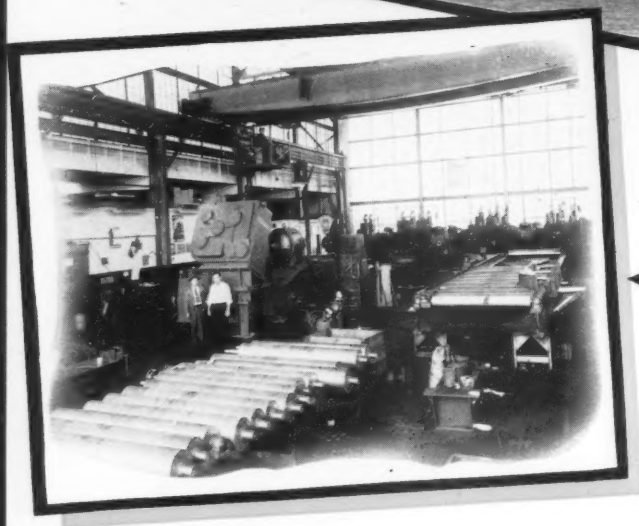
THE VAUGHN MACHINERY COMPANY . . . CUYAHOGA FALLS, OHIO, U. S. A.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

BRODEN

Specializes in Narrow Strip and Wire Mill Equipment

West view of Broden-Wean plant



Partial view of assembly shops

THE Wean Engineering Company, Inc., have long been recognized as Specialists in sheet, strip and tin mill equipment » » » The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

The expansion of the facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., is indicated in the accompanying photographs, and makes it possible to serve the steel industry more effectively.

ANNOUNCING

Broden has entered into an exclusive arrangement to manufacture and sell the Holmquist line of machinery for the manufacture of barbed wire and wire fencing.

The BRODEN CONSTRUCTION Company, Cleveland, O.

Subsidiary of

The WEAN ENGINEERING Company, Inc., Warren, O.

Announcing...

Greater Savings for Users of Fine Hole Dies

ROUGH CORED ROUND HOLE DIES

Now Available in Size .004" - .007"

As a further contribution to the economy of carbide die use on war production—we announce the availability of cored dies in a size averaging .004"–.007".

Formerly practical to produce only in rough drilled form at substantially higher costs than cored dies, these new dies bring to the field of fine, steel-wire drawing a new order of economy in carbide die cost.

Previously, .015" has been the minimum hole size of standard cored dies available—for finishing in the user's die room to average minimum size of .020". With the new cored size, .004"–.007", available at standard cored die prices plus 10%, your die room can now finish cored dies down to .010" minimum hole size, *eliminating the extra time and cost of piercing and rough drilling blank dies,* or the procurement of higher priced, rough drilled dies from the carbide supplier. Under present conditions of limited manpower and high operating costs, this saving in time is particularly important.

These dies are available in R-2 nibs only with casing sizes of 1" x 9/16" and 1½" x 9/16". Nominal quantities are now in stock.

CARBOLOY COMPANY, INC., DETROIT, MICH.

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia Pittsburgh • Seattle • Thomaston, Conn.

Authorized Distributors: Hartley Wire Die Co., Thomaston, Conn.; Michigan Wire Die Co., Detroit. *Canadian Distributor:* Canadian General Electric Co., Ltd., Toronto. *Foreign Sales:* International General Electric Co., Schnectady, N. Y.

CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

COMPLETE DIE SERVICE FOR WIRE, BAR, TUBING AND SHEET METAL

Gilron

COATING COMPOUNDS

are establishing new standards in

WIRE DRAWING

These new compounds, now thoroughly proven in mill practice, are an important contribution to wire drawing.

"Gilron" coatings enable wire drawers to operate machines at speeds heretofore considered impracticable and are proving a boon to speeding up production of wire for war purposes increasing die life, preventing the scratching of wire, eliminating the necessity for lime in many cases and producing a better finish.

This is much to claim, but results in a number of large wire mills substantiate the statements. These coating compounds have been of particular value in the more difficult operatings — drawing stainless, alloy and high carbon wire, and on welding rods. Multiple reductions can be drawn without re-coating.

Coatings for Drawing
Stainless, High and Low
Carbon and Copper Coated Wire

We shall be glad to confer with you on your drawing problems. Write or telephone for full particulars.

Gilron Products Company

1559 EAST 40th ST.
CLEVELAND, OHIO

Telephone:
HEnderson 8375

Wire wrapping for fragmentation bombs

The coil of rods shown above is drawn into wire of a special shape to be used in wrapping fragmentation bombs. These bombs are used by low-flying airplanes against enemy infantry. When the bomb strikes, the explosion rips the wrapping into bits and sends them zinging out in all directions like so many bullets.

The supplying of large quantities of rods to processors for use in fragmentation bombs is one of the many

ways in which Bethlehem mills are serving in the war effort. Almost every kind of war equipment depends upon steel wire, either as an actual working part, or at least in its manufacture. If you find Bethlehem Wire difficult or impossible to obtain, we hope you will remember that a very large proportion of our output has been assigned to duty in the fighting areas, and for vital applications on the war-production front, at home.

TO GET THE ULTIMATE *Use*

Vascoloy RAMET

T M. REG .U S. PAT. OFF

TANTALUM-TUNGSTEN CARBIDE DIES

FOR DRAWING	For drawing fine wire, heavy wire, special shapes, tubing, etc. For shell and cartridge cases from the blank to completed case.
FOR COLD HEADING	Rivets and any number of small upset parts required in large quantities to close tolerance.
FOR COLD NOSING	Artillery shells.
FOR EXTRUDING	For extruding operations on a wide variety of parts because of quantity and tolerance requirements.

MORE PRODUCTION, BETTER FINISH, AND CLOSER TOLERANCE—these characterize the high performance of Vascoloy-Ramet Tantalum-Tungsten Carbide Dies. All these factors contribute to getting the ultimate with drawing, cold heading, and extruding dies.

TANTALUM-TUNGSTEN CARBIDE DIES are now used for countless forming, nosing, drawing, cupping and extruding operations on articles of war materiel. Our special die department offers its services and experience to manufacturers making products requiring these operations.

If carbide dies can be used to advantage, we will design and produce Tantalum-Tungsten Carbide Dies that will assure you the ultimate in performance.

437

Ramet

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS • DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES • IN CANADA: CARBIDE TOOL & DIE CO., LTD., HAMILTON, ONT.

TANTALUM-TUNGSTEN CARBIDE

FOR HIGH PERFORMANCE . . . *Specify* Vascoloy RAMET DIES

WIRE

for a thousand *Wartime* uses

From rods to be forged into airplane parts to fine gauge wire for paper matches, Continental manufacturer's wire is made to meet exacting product requirements. The production of wire for war is building a reserve of specialized metallurgical experience and production facilities at Continental. These resources will be at your call when war ends. Continental will be better equipped than ever to meet your wire needs, and to work with you on your plans for new products and new production. We invite your inquiries now.

CONTINENTAL STEEL CORP., KOKOMO, INDIANA

CONTINENTAL STEEL CORPORATION
★
SUPERIOR
WIRE

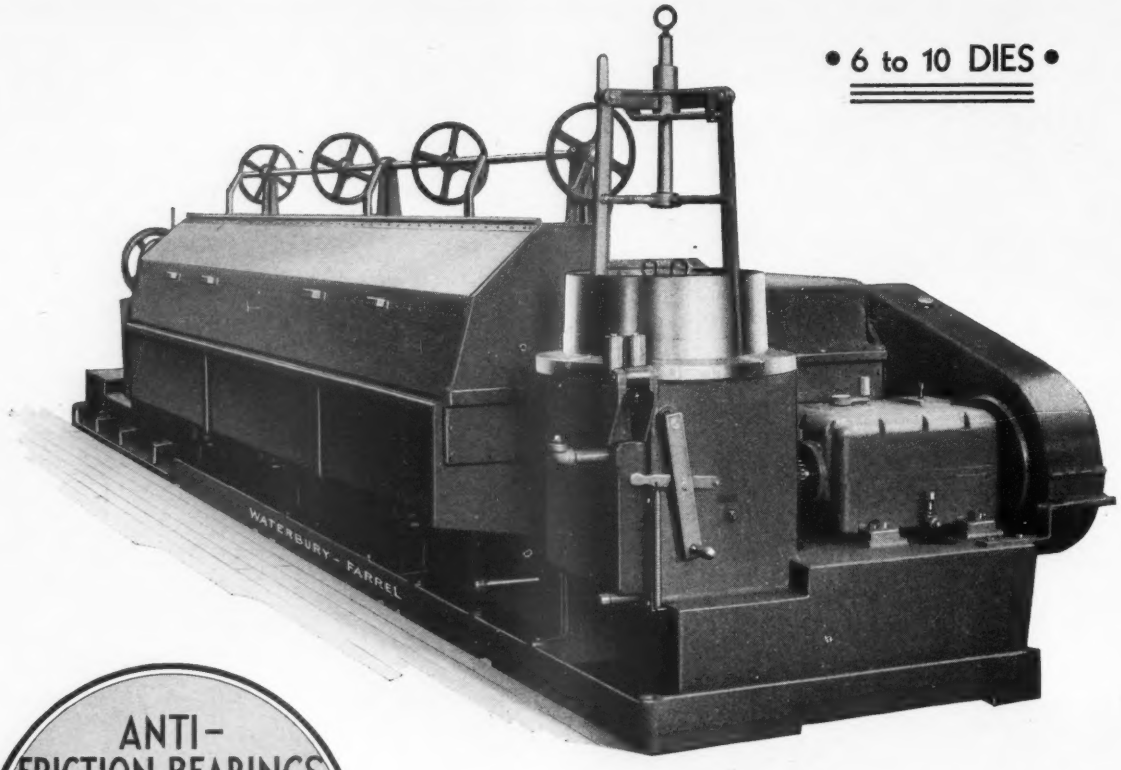
CONTINENTAL
STEEL CORPORATION

PRODUCERS OF— SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Coated, Long Terne, etc.
WIRE: Bright Basic, Annealed, KONIK, Coppered, Tinned, Special Manufacturer's, etc.

WATERBURY-FARREL

NO. 1 TANDEM WIRE DRAWING MACHINE - FOR BRASS OR COPPER

• 6 to 10 DIES •



ANTI-FRICTION BEARINGS

FORCED FEED LUBRICATION

SPIRAL BEVEL GEARING

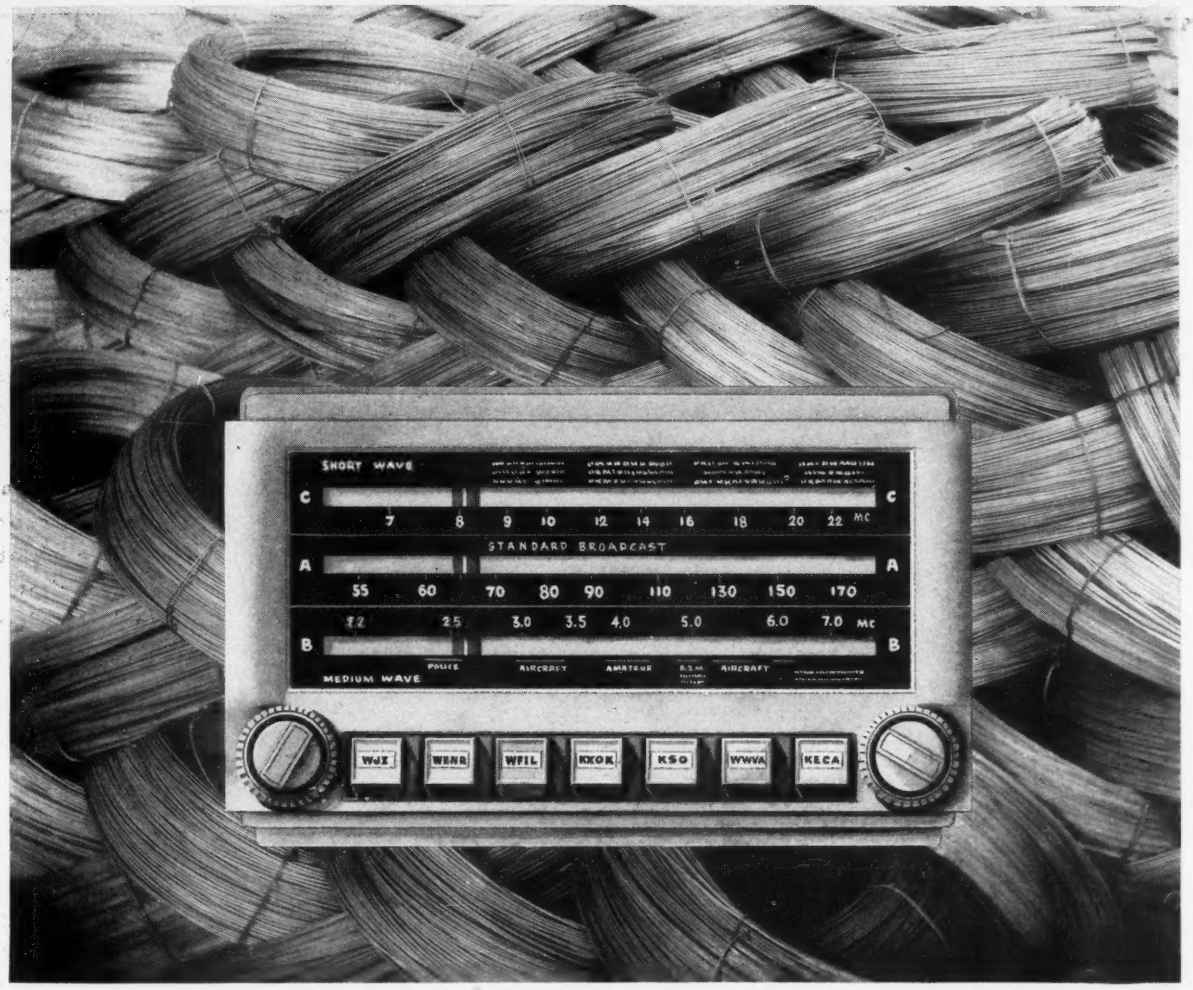
Change gearing provides four finishing speeds with a single speed AC main motor.

Block driven through a clutch which may be disengaged to permit rotation by hand.

THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

WATERBURY, CONNECTICUT U.S.A.

CLEVELAND CHICAGO NEWARK, N. J.



Get Acquainted

with the folks who make Wheeling Wire. When you know the folks, you'll understand the quality they can build into a product.

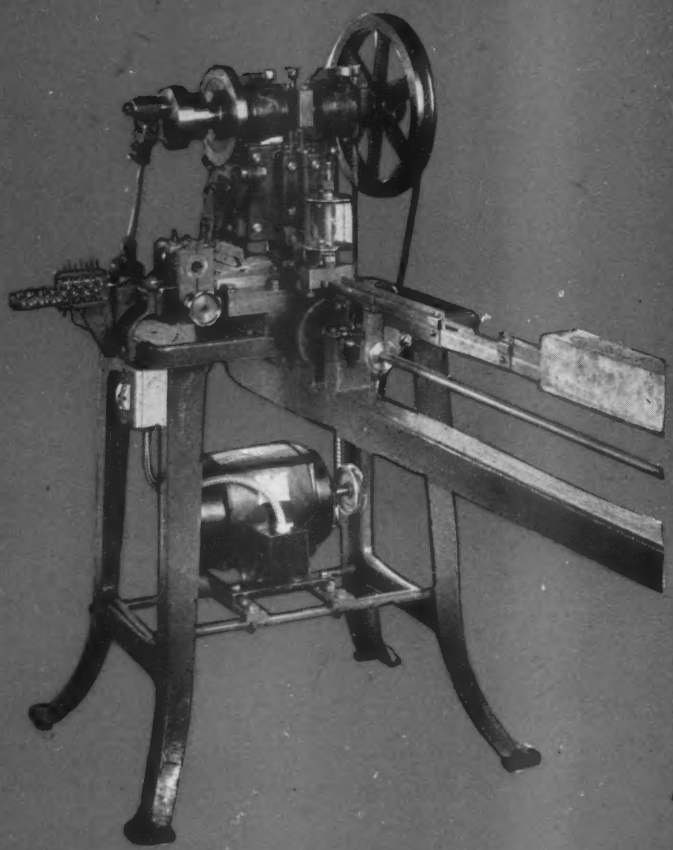
You can hear them every Sunday afternoon on the Blue Network Station in your town, in America's Original Family Broadcast. (Consult your newspaper's radio program listings for time and station.) They're as genuine as the quality and integrity you will find in Wheeling Products—a quality *assured* the fabricator who uses Wheeling Wire.

WHEELING STEEL

The Musical Steelmakers with Lew Davies and talented members from Wheeling Employee homes. Heard throughout America on the Blue Network—
5:30-6:00 E. W. T.

IT'S WHEELING STEEL!

NILSON *Automatic* W R



STAPLE FORMING MACHINE NO. 1

This improved automatic staple machine takes the wire directly from the coil, straightens it, cuts off and forms staples at a high rate of speed. Adhesive is applied close to the forming tools and staples travel along the guideway through an electric heater for quick drying. The length of strip or number of staples to the finished piece is controlled by a counting and cut-off device. Length of feed is adjustable to accommodate different sizes of staples. A special attachment is required for chisel-point staples.

SPECIFICATIONS

Production	375 Staples per Minute
Approximate Net Weight	600 lbs.
Approximate Gross Weight	725 lbs.
Floor space (without wire reel)	24" x 72"
Box Size for Export	35" x 36" x 48" high

Nilson Automatic Staple Forming Machines have proven very practical and durable. Over a period of years they have built a fine record for trouble-free operation. Years of special machine design experience were in back of the first model, and it met quick success. Since then several improvements have been added when experiment and test proved them practical. Today these machines give you the best in low production cost equipment for the manufacture of staples.

THE A. H. NILSON M

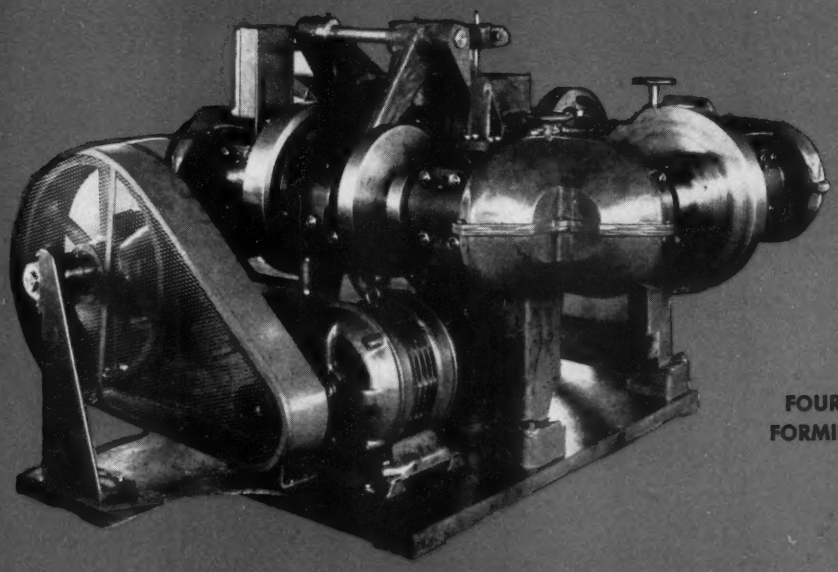
BRIDGEPORT

Builders of Special Machinery Fo

RE *Forming* MACHINERY

THE IMPROVED NILSON STANDARD FOUR-SLIDE WIRE FORMING MACHINERY

Nilson machines, made in a wide range of models, are the result of continuous improvement. Are efficient and practical, and designed for the rapid production of a great variety of products.



FOUR-SLIDE WIRE FORMING MACHINE

Wire forming operations of Nilson Four-Slide machines cover such products as paper clips, buckles, coat and hat hooks, cable rings, screw eyes, staples, cotter pins, package handles, egg-beater blades and numerous other articles of complex shapes. Wire may be round or flat and forming is done direct from coiled stock.

Special features include four forming slides of equal length, wire feed that is silent and frictionless, return motion of cut-off tool actuated by cam, special lubricating system for cam-roll studs, wire feed operated in straight line from crank disc and an improved wire-former bracket. Nilson machines take the wire directly from the coil, ***straighten,*** feed ***cut-off*** and ***form,*** in one continuous operation.

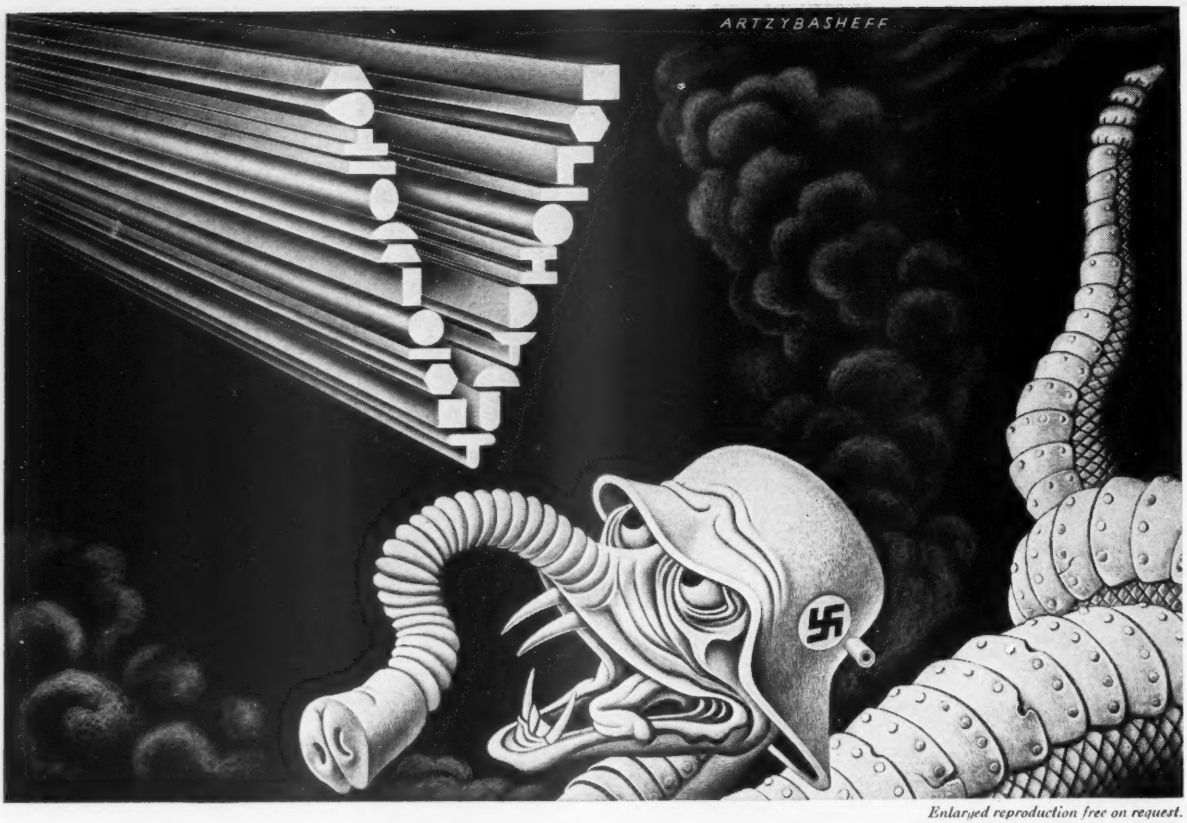
The wire feed is positive and simple, and does not depend on friction for its action. The gripping members are actuated by an independent motion which assures the same positive pull and tension on both long or short lengths of wire. The power operating the feed is applied in a straight line from the crank disc—an exclusive feature of the Nilson machine.

Accessories include a form lifter and press attachment, and a secondary cut-off can be furnished to any size machine without drilling extra holes.

N MACHINE COMPANY

CONN., U. S. A.

For Over Fifty Years



Enlarged reproduction free on request.

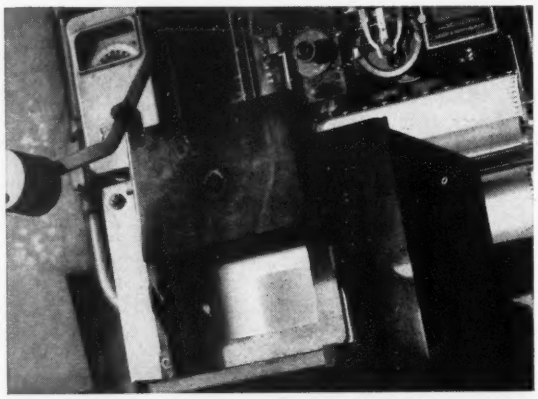
Wire to the Axis

Wissco wire is one of America's most versatile war weapons. In its various kinds and shapes it is helping to make and serving vitally *in* every plane, tank, ship and gun. And in almost everything our fighting forces use or wear or fight with.

During our 122 years, in which we have pioneered many of the basic developments in this highly specialized material, quality and dependability in wire have become Wickwire Spencer traditions.

If you have need for wire, put it up to experts. Wickwire Spencer Steel Company, 500 Fifth Avenue, New York (18); or Buffalo, Chicago, Detroit, Philadelphia, San Francisco, Worcester.

EVERYTHING IN WIRE. High and Low Carbon Wire—Wire for Springs, for Wire Rope, for use in scores of industries, in a variety of sizes, tempers, grades and finishes.



WIRE METALLURGY is a down-to-earth science in the Wickwire Spencer laboratories. It helps customers find answers to all sorts of wire applications.

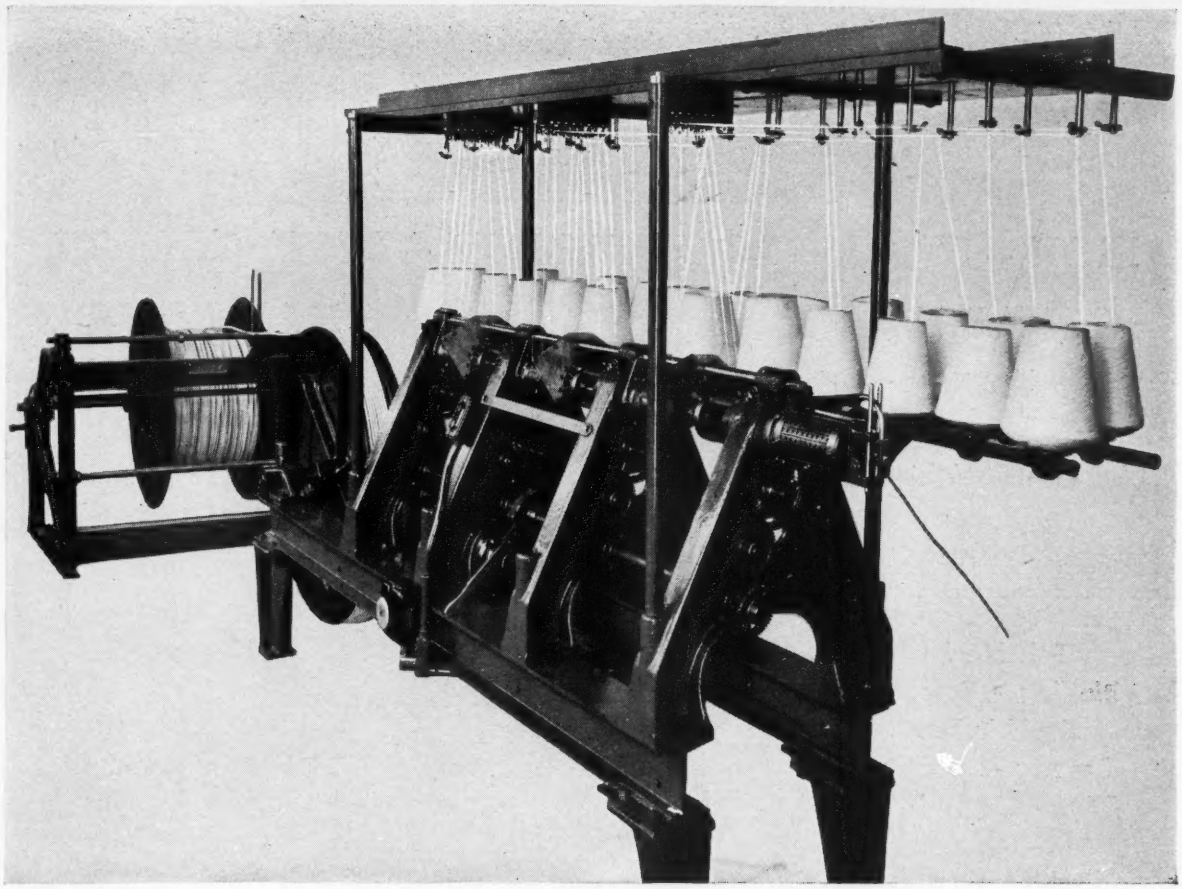
SEND YOUR WIRE QUESTIONS TO WICKWIRE SPENCER

Copyright 1943, Wickwire Spencer Steel Co.

WISSCO WIRE

BY WICKWIRE SPENCER

WISSCO PRODUCTS



FIDELITY SINFRA MULTIPLE-HEAD HIGH-SPEED COVERING MACHINES . . .

Knits two or three cotton coverings on bare wire up to #6 gauge—also flat or shaped, continuous-strip material, 1200 to 1500 feet per hour. Saves rubber since cotton coverings, impregnated, form excellent insulation. Straightening rollers operate horizontally and vertically. Each head knits one cover. 20″ or 36″ capstan take-off—separate haul-off reel stand, 40″ O.D., with traverse mechanism, 1000 lb. capacity.

Other advantages include: Automatic electric stop motion on each yarn; improved knitting head and needle design; knits direct from large cones; quiet operation reduces operator fatigue.

Available in double- and triple-head types. Write for Bulletin.

ARMY E NAVY

32 YEARS' EXPERIENCE

Designers and Builders of Intricate, Automatic Precision Machines

FIDELITY MACHINE COMPANY

3908-18 FRANKFORD AVENUE, PHILADELPHIA 24, PA.

WIRE for Practically All Purposes and Requirements

IRON – STEEL – LOW CARBON – HIGH CARBON

SHAPES

Square - Keystone - Flat
Round - Half Round - Special
Shapes - Straightened
and Cut

Tempered and Untempered

FINISHES

Liquor Finish - Bright
Galvanized - Coppered
Enameled All Colors
Annealed - Tinned
Oil Tempered

FOR

Belt Hooks
Binding - Bonnets
Bookbinders
Brooms - Brushes
Clips - Cotter Pins
Crimping
Cushion Springs
Florist - Glass Wire
Grape Tying
Hair Pins - Heddles
Hook and Eyes
Link Fabrics
Lock Washers
Mattresses
Picture Cord - Pins
Rock Fasteners
Special Springs
Ropes - Stapling
Stone Wire
Tags - Weaving

• FLY SCREEN WIRE CLOTH • GALVANIZED HARDWARE CLOTH •

HIGH CARBON FLAT WIRE TEMPERED AND UNTEMPERED

Gutter Broom Square
Curtain Spring
Snap Spring
Lock Spring
Fish Tape
Bobby Pin — Flat & Half-round

LOW CARBON

Cotter Pin
Box Stitching
Bookbinders

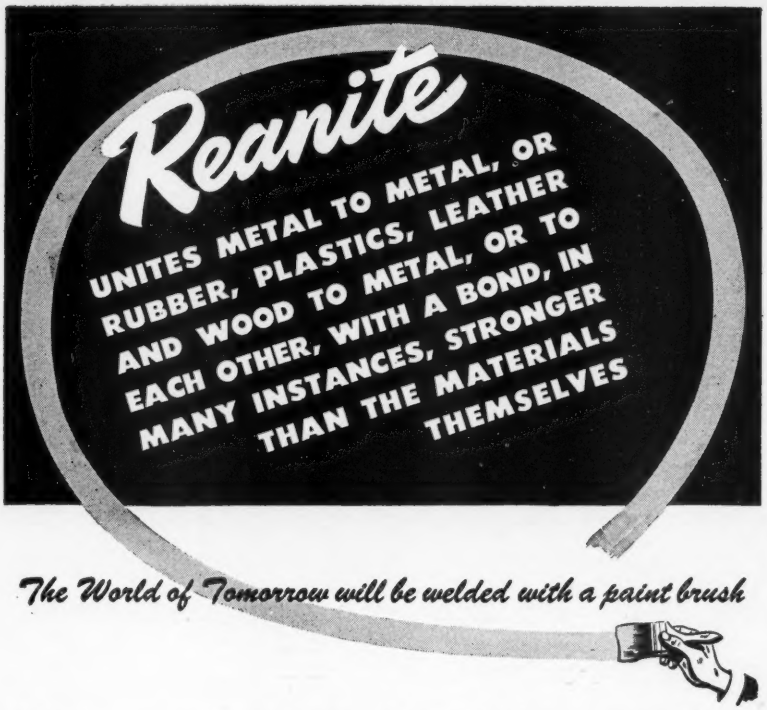
Highest Quality and Service Guaranteed

Established 1905

The Seneca Wire & Mfg. Company

Fostoria, Ohio

Representatives and Warehouses in principal cities.


Reanite
UNITES METAL TO METAL, OR RUBBER, PLASTICS, LEATHER AND WOOD TO METAL, OR TO EACH OTHER, WITH A BOND, IN MANY INSTANCES, STRONGER THAN THE MATERIALS THEMSELVES

The World of Tomorrow will be welded with a paint brush

EQUAL or superior to riveting or spot welding for many purposes, the Reanite Bonding Process* not only accomplishes substantial savings in production man hours, but through its unique ability to bond entirely unrelated materials permits design engineers to take full advantage of the specific properties of each.

The normal bond between metals exceeds 1000 lbs. psi on a pull test, and for some metals runs as high as 3000 lbs. On bonds formed between rubber and metal, or between wood and metal, wood and rubber, or between wood and wood, the materials themselves will give way before the bond.

Reanite is suitable for almost all metal surfaces — iron, steel, stainless steel, magnesium, aluminum, aluminum alloys, copper and bronze. It is particularly effective in bonding light metals such as magnesium and aluminum.

The Reanite Bonding Process is simple. Reanite adhesive is applied by brush or spray gun to the surfaces to be joined. Mild heat and pressure is applied.

The Reanite bond is insoluble in water, is *non-corrosive to metals,* and is effective through a temperature ranging from — 40 °F to as high as 300 °F.

Is Reanite available now? Yes. Reanite is formulated through cyclic modifications of materials high on the critical list, but for essential end-uses Reanite is available for immediate shipment.

**The Reanite Process is fully protected by United States and foreign patents, granted or pending.*

U. S. STONEWARE
AKRON, OHIO

REANITE
will be on display in Room 855, Palmer House, Chicago during the

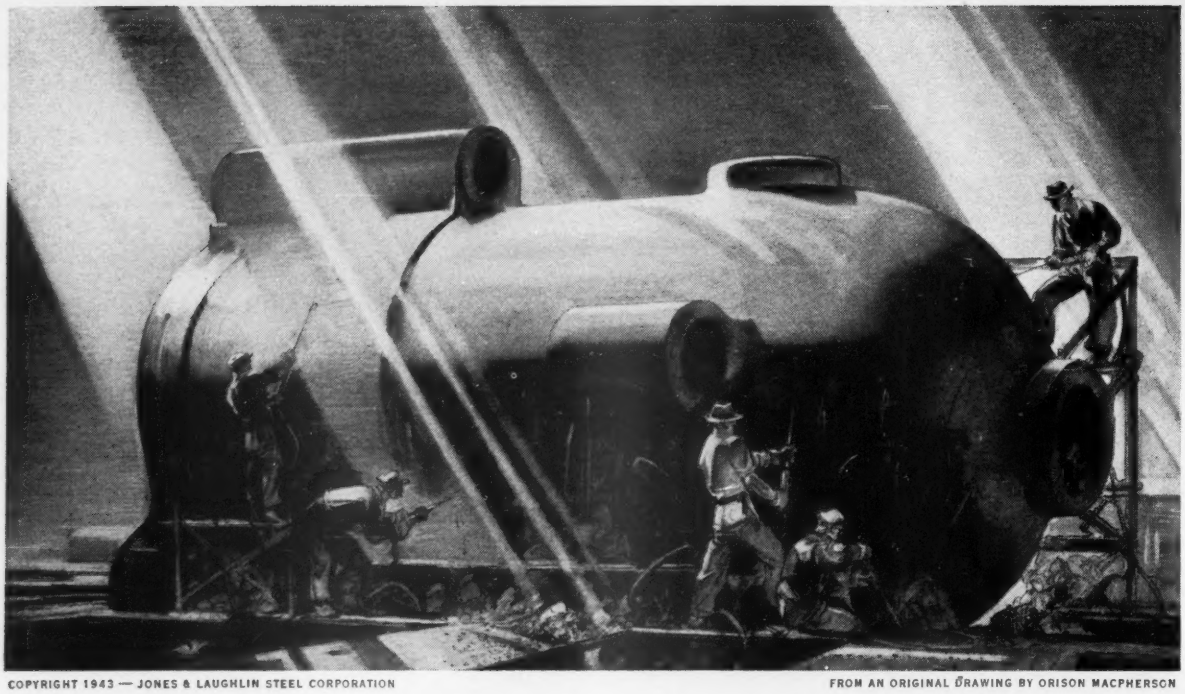
NATIONAL METAL CONGRESS
October 18-22

★

Other U. S. Stoneware products on display will include:

- TYGON TANK LININGS
- RESILON TANK LININGS
- TYGON TEMPRO-TEC
- TYGON PAINT
- TYGON MASKING TAPE
- RUSCAT METAL CLEANER
- TYGON FLEXIBLE TUBING
- ACID-PROOF BRICK AND CEMENTS
- LEAD ANODES
- "CERATHERM 500" HEAT SHOCK RESISTING CHEMICAL STONEWARE

REANITE—Another U. S. Stoneware Product Perfected Under The Impetus Of War—Designed For The Needs Of Peace



COPYRIGHT 1943 — JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

STRONG STEEL—THE METAL BY WHICH OTHER METALS FLY AND FIGHT

Gouged, hammered, pried from its mold of sand and gagger-bars, this mammoth one-piece casting of war-steel emerges in a form of massive strength to do a job on the production front as no other material could do it. A product of the art and skill of J&L foundrymen, this casting, a hydraulic cylinder, is the heart of power for a gigantic extrusion press. Strong steel in this and other castings, weighing up to 280,000 pounds, enables the giant mechanical presses to exert pressures so great as to squeeze aluminum, copper, brass and other metals, as well as certain steels, through small die openings like a pastry cook extrudes cake-icing through the tip of a pastry cone. By this extruding process these other metals are formed into hundreds of parts for aircraft engines, flying instruments and airplane assemblies as well as parts for weapons and other fighting equipment.

Thus steel — strong steel — which is being produced at the rate of 90 million tons a year, is doing two war jobs. First: steel is serving on the invasion fronts in the form of tanks, guns, ships, planes, ammunition and other military supplies, and second: it is serving on the production front in the form of machines, large and powerful, small and intricate, that shape other metals and materials including plastics and certain steels into equipment and arms for victory.

PITTSBURGH WORKS

ARMY E NAVY

ALIQUIPPA WORKS

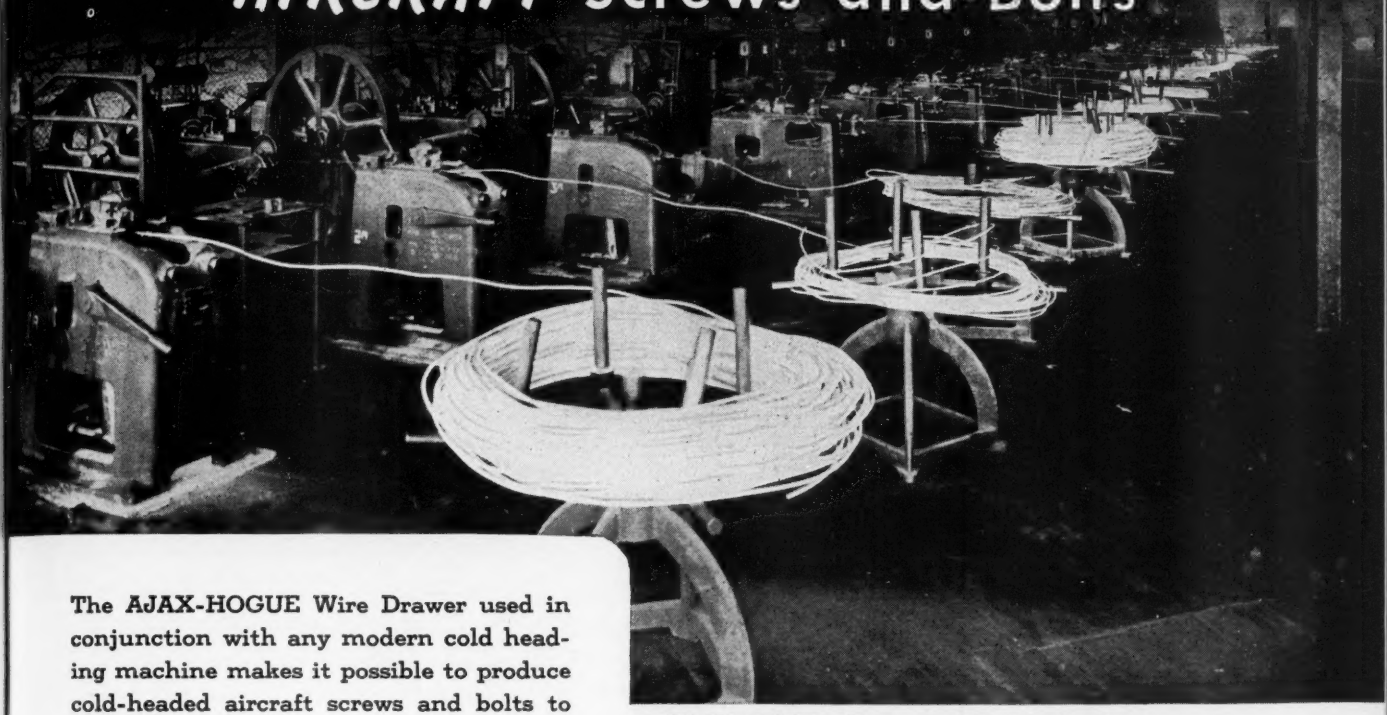
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL

AJAX-HOGUE Wire Drawers produce close tolerances on *AIRCRAFT* Screws and Bolts

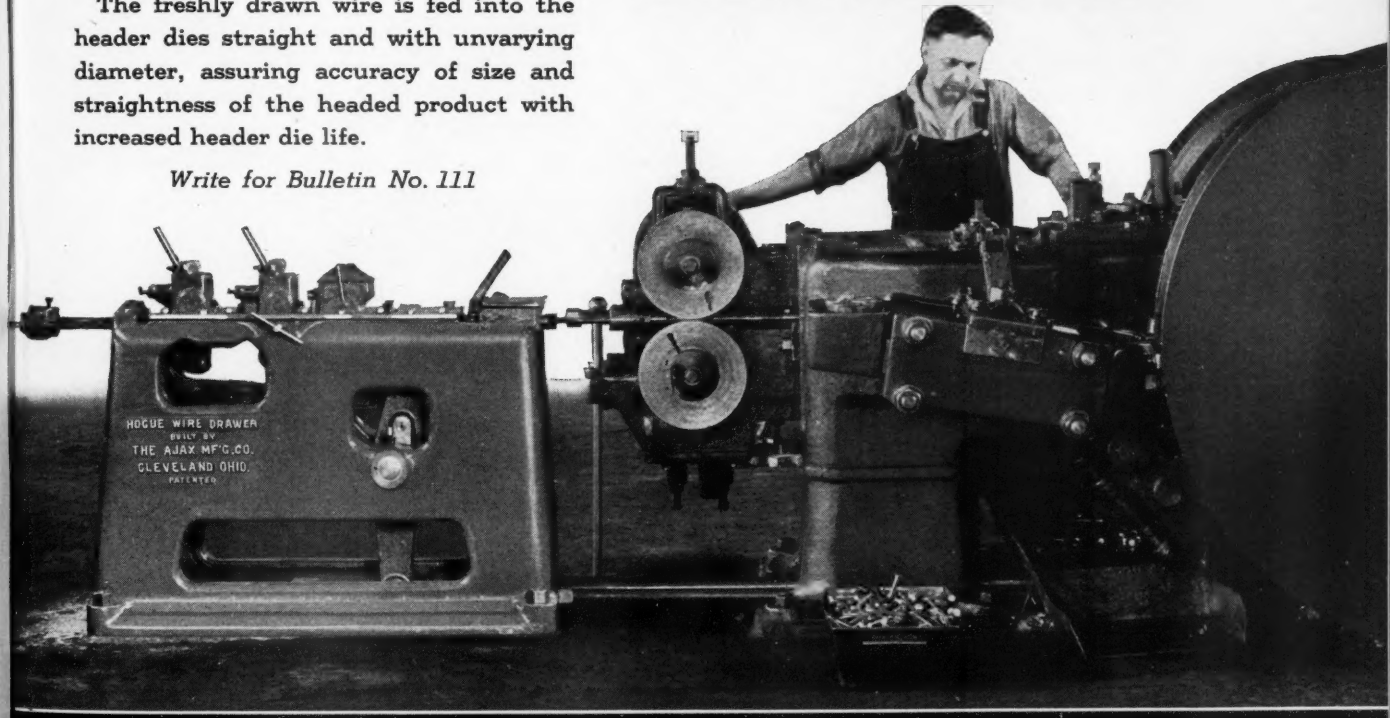


The **AJAX-HOGUE** Wire Drawer used in conjunction with any modern cold heading machine makes it possible to produce cold-headed aircraft screws and bolts to aircraft tolerances.

The freshly drawn wire is fed into the header dies straight and with unvarying diameter, assuring accuracy of size and straightness of the headed product with increased header die life.

Write for Bulletin No. 111

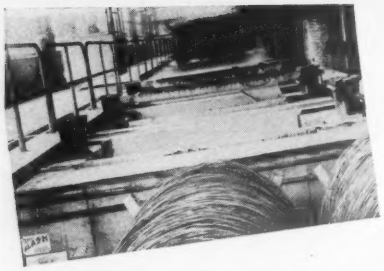
AJAX-HOGUE Wire Drawers are built in five sizes with capacity from 1/4 inch to 3/4 inch diameter.



THE **AJAX** MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS



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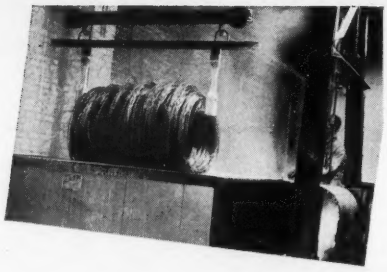


Morrison Flash Bakers

are saving time and labor, cutting costs and speeding production of a higher quality product in 29 plants of the following companies—

AMERICAN STEEL & WIRE CO.
Cleveland, Ohio

AMERICAN STEEL & WIRE CO.
New Haven, Connecticut

AMERICAN STEEL & WIRE CO.
Joliet, Ill.

AMERICAN STEEL & WIRE CO.
Worcester, Mass.

BETHLEHEM STEEL COMPANY
Sparrows Point, Maryland

BETHLEHEM STEEL COMPANY
Johnstown, Penna.

COLUMBIA STEEL COMPANY
San Francisco, California

E. H. EDWARDS COMPANY
San Francisco, California

JOHNSON STEEL & WIRE CO.
Worcester, Mass.

JONES & LAUGHLIN STEEL CO.
Aliquippa, Penna.

LACLEDE STEEL COMPANY
St. Louis, Missouri

MID-STATES STEEL & WIRE CO.
Crawfordsville, Indiana

NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

A. P. NEWALL CO.
Glasgow, Scotland

PAGE STEEL & WIRE CO.
Chicago, Ill.

RICHARD JOHNSON & NEPHEW LTD.
Birmingham, England

RUSSELL, BURDSALL & WARD BOLT & NUT CO.
Port Chester, New York

SENECA WIRE & MFG. CO.
Fostoria, Ohio

STEEL CO. OF CANADA, LTD.
Notre Dame Works, Montreal

STEEL CO. OF CANADA, LTD.
Canada Works, Hamilton

STEEL CO. OF CANADA, LTD.
Dominion Works, Montreal

TENNESSEE COAL & IRON & R. R. CO.
Birmingham, Alabama

TINSLEY, LTD.
England

UNION WIRE ROPE CORPN.
Kansas City, Mo.

WICKWIRE BROS. INC.
Cortland, New York

WICKWIRE SPENCER STEEL CO.
Buffalo, New York

WILSON STEEL & WIRE CO.
Chicago, Ill.

YOUNGSTOWN SHEET & TUBE CO.
Indiana Harbor, Indiana

YOUNGSTOWN SHEET & TUBE CO.
Youngstown, Ohio

Check these advantages of MORRISON FLASH BAKERS

1—Space saving—size of a lime tank
2—Fit straight line or circle setups
3—Reduce cleaning house fog
4—Rust-free rod
5—High capacity
6—Acid brittleness recovery of about 95%
7—Rod remains on hook
8—Only a few minutes required for baking even fine wire

Descriptive Literature Sent on Request

MORRISON ENGINEERED

MORRISON ENGINEERING CORPORATION
5005 EUCLID AVENUE · · CLEVELAND, OHIO
Associate Companies: MORRISON ENGINEERING OF CANADA, LTD. TORONTO, ONTARIO
CARRIER ENGINEERING CO., LTD. LONDON, ENGLAND

WIRE

Electro-Galvanized

by MEAKER

Process

High Carbon No Problem! Enjoy the Experience of Coating High Carbon Wire as Easily and Economically as Fence Wire — *without affecting its physical properties*

Thickness Accurately Controlled...

3 oz. or .1 oz. per sq. ft. is obtained with equal ease.

Coating will not Peel...

Wire may be drawn down to finer sizes, twisted, bent or flattened after galvanizing.

Costs...

for producing this quality galvanizing are less than the old conventional method.

Will *your* product have the advantage of this quality protective coating to meet Post War demands? More and more Meaker installations are being made with this in view. Ask Meaker for details.

THE MEAKER COMPANY

1635 South 55th Avenue, CHICAGO 50

WARNER COMPANY
Lime
Bell Mine
Products
BELLEFONTE DIVISION

Uninterrupted Production Is Of Prime Importance In The War Effort. Every Pound of Wire Is Needed.

Cut "Rejects" By Using Bell-Mine Pulverized Lime, Manufactured From Deep Mined Clean Stone.

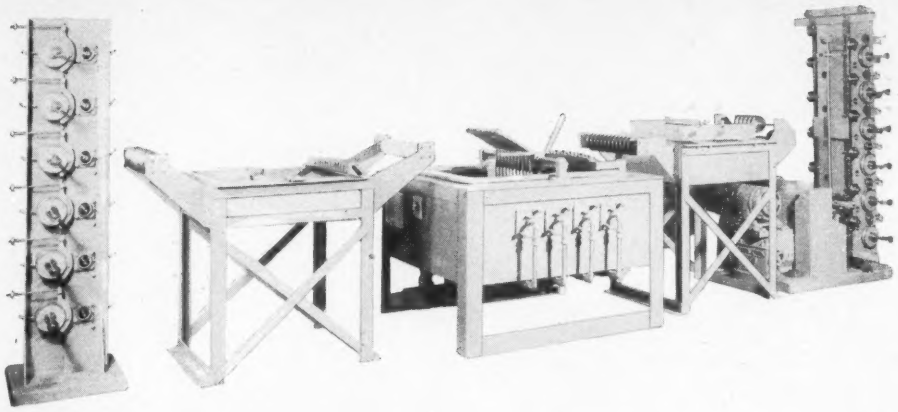
You Can Depend Upon Day To Day Uniformity of Bell-Mine Rotary Kiln Pulverized Lime.

WARNER COMPANY

BELLEFONTE DIVISION

OFFICES: PITTSBURGH, PA. • PHILADELPHIA, PA. • BELLEFONTE, PA. • NEW YORK, N. Y.

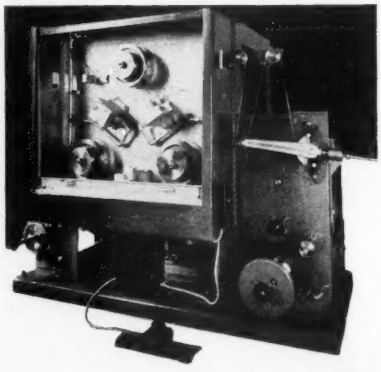
"BUY WAR BONDS"



WIRE TINNING OUTFITS

Also Horizontal Takeups and Let-offs supplied for larger size wires and accommodating larger reels.

FULL LINE OF
WIRE ENAMELING
MACHINES

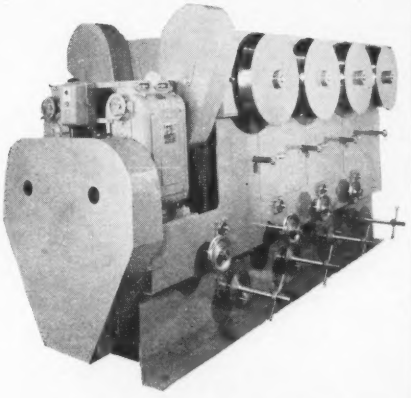


HIGH SPEED
WIRE DRAWING MACHINE
for Intermediate and Fine Wire

EST. 1855 INC. 1915

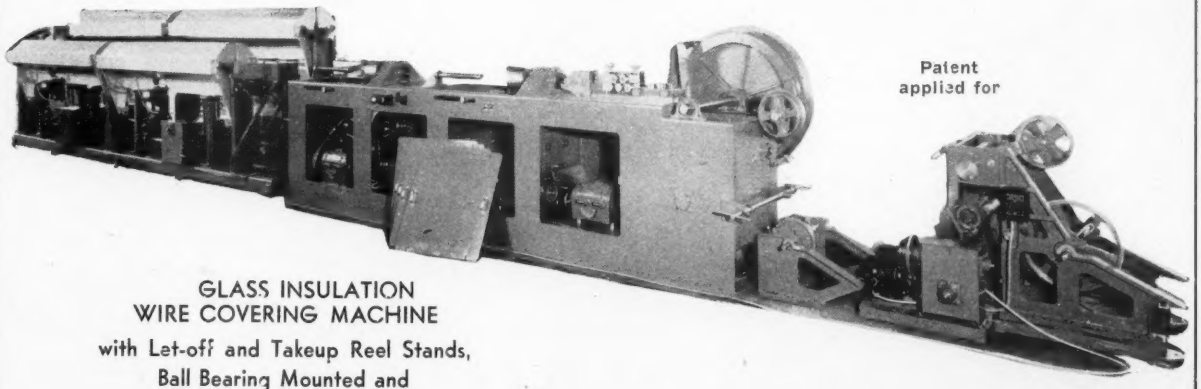
"American"
AIM INSULATING MACHINERY COMPANY

517 West Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.



MULTIPLE WIRE PULLOUT
with Slip Friction Takeups and
Speed Variators for Tinning,
Annealing and Saturating
Processes, etc.
Ball Bearing Mounted

COMPLETE
LINE OF
WIRE INSULATION
WINDING MACHINES



Patent
applied for

GLASS INSULATION
WIRE COVERING MACHINE
with Let-off and Takeup Reel Stands,
Ball Bearing Mounted and
Variable Speed Motor Drive,
Baking Ovens with Two Coat Varnish Applicators,
and Individual Automatic Temperature Controllers.

Let us confer with you on your wire machinery problems.

RODINE

Saves Time • Saves Money • Saves Acid

RODINE is an inhibitor that confines the action of pickling acids to the removal of scale and rust—prevents the needless waste of acid dissolving metal.

RODINE, in addition to saving both acid and metal, extends the life of pickle baths, minimizes the blistering and embrittlement of steel and serves as a protection against over-pickling.

RODINE, important at all times, is essential with forced production and for the cleaning of expensive and difficultly pickled alloy steels required in ever increasing tonnage for war products.

"Cuprodize" with Cuprodine

to obtain a tight, adherent coating of copper deposited on steel without current. Cuprodine assures more drafts, longer die life, less metal pick-up and less scratching and breakage of drawn wire.

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note: West Coast Plants may address inquiries and orders for prompt delivery to, Leon Finch, Ltd., 728 East 59th St., Los Angeles, Calif.

American Chemical Paint Company, Ambler, Pa.
Please send me general Technical Service Data Sheets on
☐ Cuprodine ☐ Rodine

*Name*_____ *Title*_____

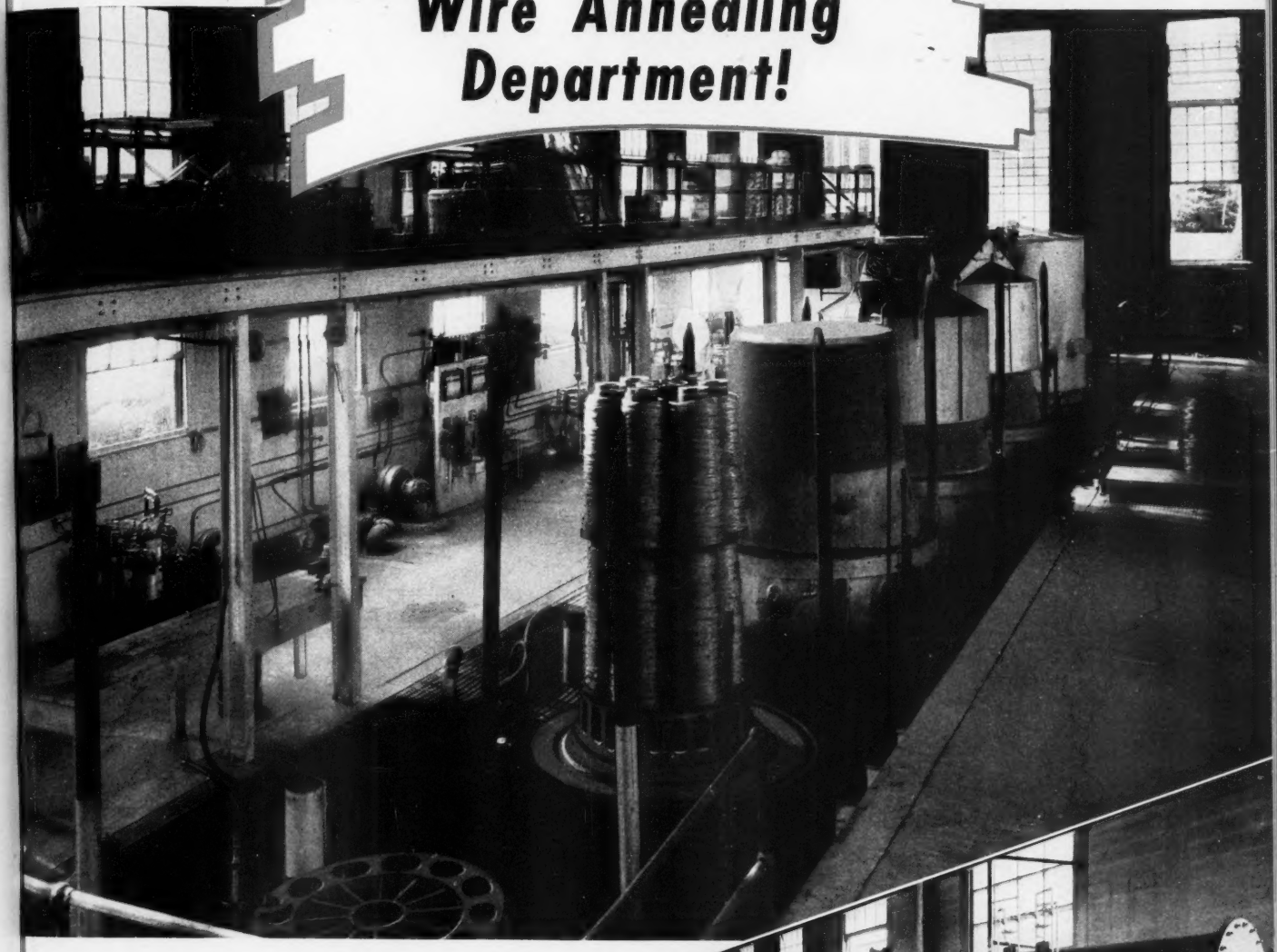
*Company*_____

*Address*_____

D-10

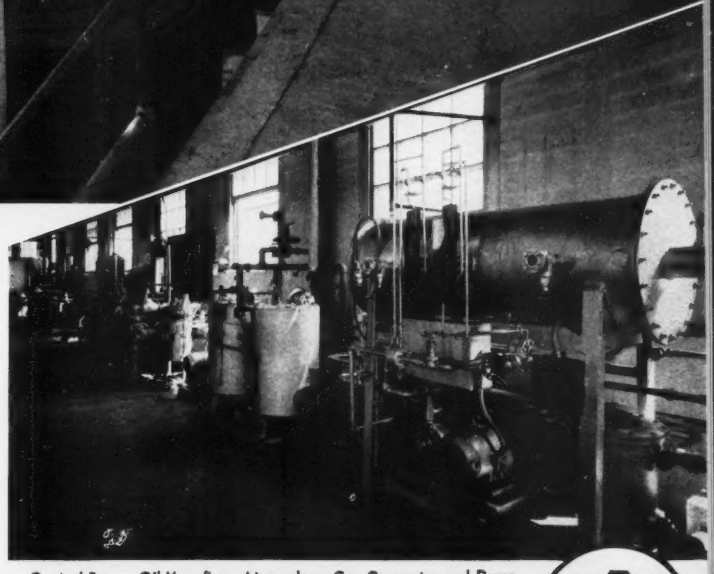
CHEMICALS ACP PROCESSES

GILBERT & BENNETT'S *new* Wire Annealing Department!



FOLLOWING a progressive policy of obtaining the best equipment for war production, which would also be best for peace time operations, the GILBERT & BENNETT MFG. CO. of Georgetown, Conn., installed these two LEE WILSON annealing furnaces and six bases with complete accessory equipment to bright anneal all of their wire. The furnace fuel is *vaporized oil*. The fuel for atmosphere gas is propane.

Write for details . . .



Control Bay — Oil Vapofiers, Atmosphere Gas Generator and Dryer

ENGINEERED AND CONSTRUCTED BY THE

Lee Wilson ENGINEERING Co., Inc.

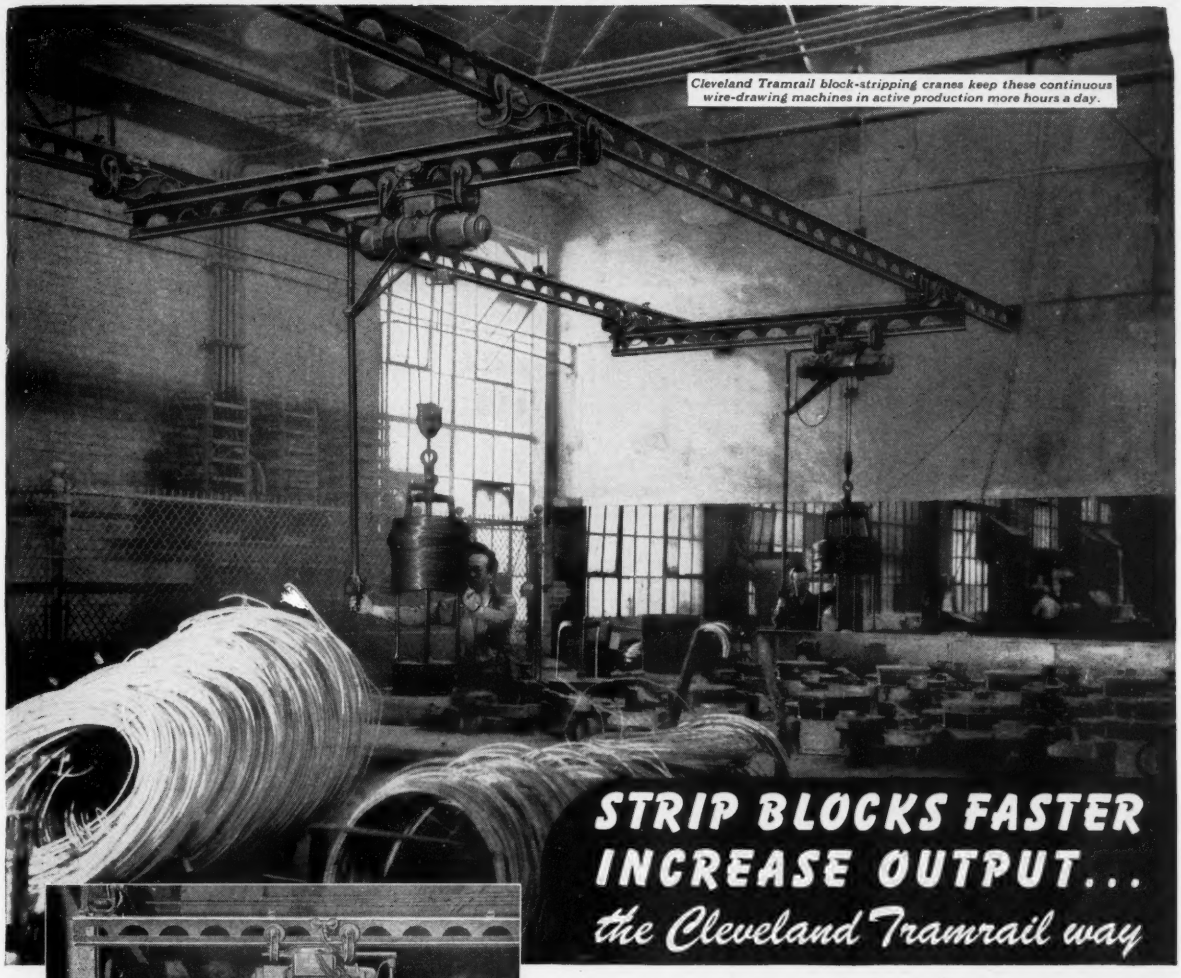
20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

* The Wilson Annealing Unit is covered by Patents Numbers 1952402 2068477 2078356 2081612 2089943, and other patents pending.

INDUSTRIAL FURNACES ★ RADIANT TUBE HEATING ★ HEAT TREATING PROCESSES

For the
Hard-to-get-at Places . . .
NORTON MOUNTED WHEELS AND POINTS
That's one of the chief uses of these Norton spindle-mounted abrasive wheels — to grind in the hard-to-get-at places on dies, molds, jigs and castings.
In air or electrically operated grinders mounted in lathes, millers and other machines they are often the means of solving troublesome production problems.
Norton Mounted Wheels and Points are available in nearly 200 standard sizes and shapes — in Alundum and Crystolon abrasives — in vitrified, resinoid and rubber bonds. Catalog 43-WP gives full information. Write for a copy.
NORTON COMPANY
Worcester 6, Mass.
Distributors in All Principal Cities
W-931B
NORTON ABRASIVES



Cleveland Tramrail block-stripping cranes keep these continuous wire-drawing machines in active production more hours a day.

STRIP BLOCKS FASTER INCREASE OUTPUT... *the Cleveland Tramrail way*

The various kinds of special heavy wire and high tensile wire drawn on this motor block are easily and quickly stripped with the Cleveland Tramrail crane.

Many mills in the United States and Canada have installations of Cleveland Tramrail block-stripping cranes and carriers. They are stripping draw blocks faster and keeping them in operation more hours a day, thus stepping up output.

Smooth rolling Cleveland Tramrail equipment has been especially designed for this service. It allows a man to take care of more blocks and draw heavier bundles. Older experienced men can usually keep pace with younger fellows when this equipment is provided.

The equipment consists of a hand-propelled crane or carrier with an electric hoist. The crane or carrier is easily pushed on its ball-bearing wheels by means of the rigid arm attached to the carrier. Push buttons, conveniently located in the handle at the lower end of the arm, control the hoist.

Cleveland Tramrail overhead materials handling equipment has been developed to serve every department in rod and wire mills.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1141 EAST 283RD ST. WICKLIFFE, OHIO.

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

SPENCER *OFFERS*

- Superior finishes.
- Improved quality in fine sizes of Bethanized wire.
- Elimination of tensile drop due to heat consumed in hot dip practice.
- Positive coatings of uniform thickness.
- Free of impurities, lumps and discoloration.
- Produced in all sizes from .001 to .025.

SPENCER WIRE COMPANY

West Brookfield Plant

WEST BROOKFIELD, MASS.

PRECISION MANUFACTURERS OF HIGH AND LOW CARBON STEEL AND ALLOY WIRES

HERE NOW!

BRICK-LINED WOOD

PICKLING TANKS

THAT USE NEITHER RUBBER NOR STEEL
. . . AND ARE GUARANTEED ACID-PROOF

ACID-PROOF CONSTRUCTION

50,000 lbs. of Sauereisen Acid Tank Sealer No. 44 (Black Cold Plastic) recently used in a Prominent Steel Mill for laying Acid Proof Brick for an ACID PICKLING DEPARTMENT FLOOR—Trial Gallon $2.00

ACID-PROOF CONSTRUCTION

PIPE JOINTS

Tons of Sauereisen Acid Proof Cement No. 31 used in laying brick in ACID PICKLING TANKS, PITS, FLOORS, ETC.—Trial 10-lb. lot $3.00

Use Sauereisen Compounds for THREADED PIPE, BELL AND SPIGOT JOINTS on Cast Iron Water Mains, or Oil Lines. Whatever your requirements we have a Pipe Joint Compound for you.

PIPE JOINTING

SPARK PLUG ASSEMBLING

Thousands of pounds of Sauereisen Spark Plug Cement No. 32 are used in cementing the center electrode into the spark plug porcelain in the SPARK PLUGS used in Automobiles, Gas Engines, Aeroplanes, Etc. Makes a leak-proof plug—meets Government Specifications. Order a TRIAL 10-lb. lot $4.00

SPARK PLUG INSULATION

ELECTRICAL INSULATION

Over 300,000 lbs. of Sauereisen Cement No. DW-30 has been used to make the leading ELECTRIC ROASTER. Order a TRIAL GALLON $2.50

One recent order called for 10,000 lbs. of Sauereisen Electric Resistor Cement No. 78 for WIRE WOUND RESISTORS on a large defense order. Make your own test. Order a trial half-gallon $3.10

ELECTRICAL APPLIANCES

Let Us Quote On Your Requirements

Send Sketches • Send Parts

Sauereisen

Since 1899

SAUEREISEN CEMENTS CO.

Manufacturers of INSA-LUTE, Technical and Industrial Cements . . . Compounds

PITTSBURGH (Sharpsburg Station) PENNSYLVANIA

Telephone: STerling 2323

Uniformity

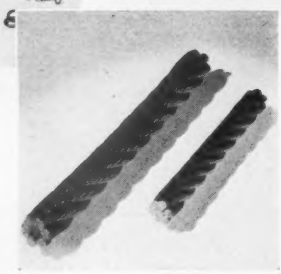
Every coil of wire heat treated by the Trauwood Process is absolutely uniform from end to end, in structure and physical properties.

Users report millions of pounds of wire heat treated by the Trauwood Process without a single rejection.

The Trauwood Electric Direct Resistance method of patenting, tempering and annealing, vastly speeds up and improves these processes, thus rendering a most valuable contribution to war production. It is being used for heat treating wire in barrage balloon, mine, and aircraft cables, in signal corps lines and many other applications which demand wire having the highest possible physical and fatigue properties.

OUTSTANDING ADVANTAGES

Much faster production . . . No decarburization or scale . . . Fully automatic — human equation eliminated . . . Easy to operate . . . Control of heating and cooling cycles extremely accurate . . . Low cost operation . . . High thermal efficiency . . . Uniform physical and fatigue properties.



"Investigate this newest development in the scientific heat treatment of carbon and alloy steel rod, wire and strip."

Our Engineers will be glad to cooperate with you.

Trauwood

THE TRAUWOOD ENGINEERING COMPANY

1740 East 23rd Street **Cleveland, Ohio**

Photograph by Courtesy of Western Electric Co., Inc.

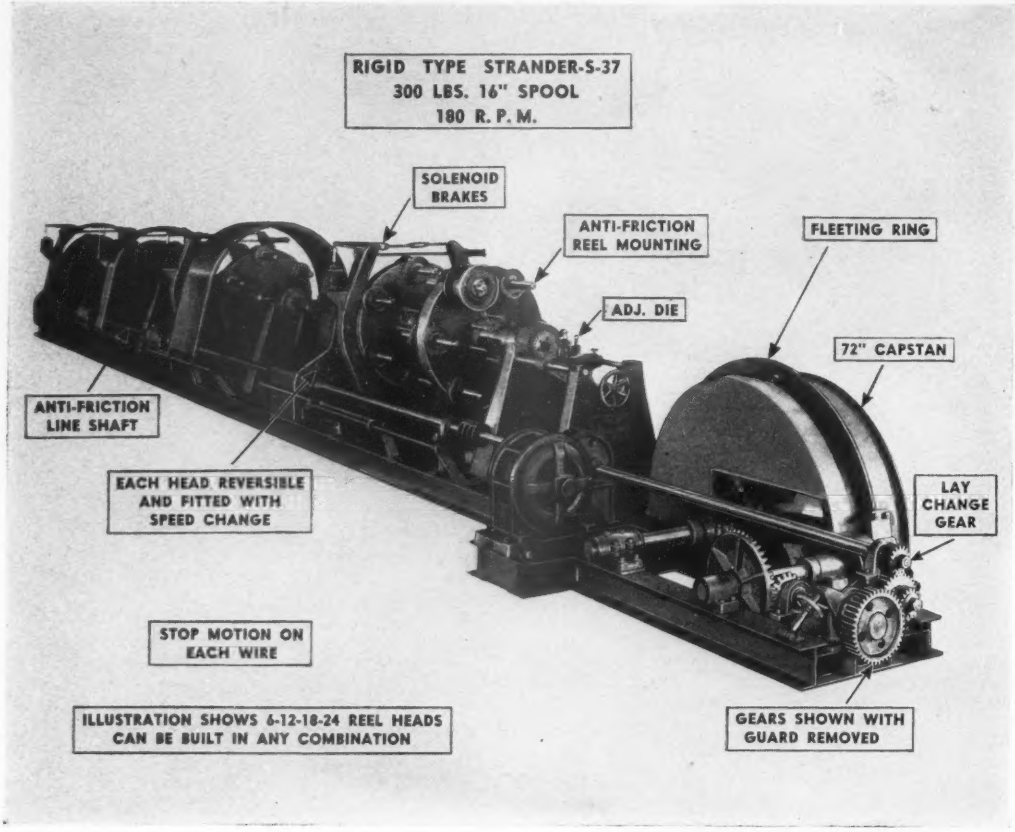
THE STEVENS METAL PRODUCTS CO.

NILES, OHIO

MANUFACTURERS OF LOW-TARE STEEL REELS AND FLANGED STEEL DRUMS FOR REELS...

Manufactured under License Arrangements with Western Electric Co., Inc.

61 SPOOL RIGID TYPE STRANDER


RIGID TYPE STRANDER-S-37
300 LBS. 16" SPOOL
180 R. P. M.
SOLENOID BRAKES
ANTI-FRICTION REEL MOUNTING
FLEETING RING
ADJ. DIE
72" CAPSTAN
ANTI-FRICTION LINE SHAFT
EACH HEAD REVERSIBLE AND FITTED WITH SPEED CHANGE
LAY CHANGE GEAR
STOP MOTION ON EACH WIRE
ILLUSTRATION SHOWS 6-12-18-24 REEL HEADS CAN BE BUILT IN ANY COMBINATION
GEARS SHOWN WITH GUARD REMOVED

The illustration above is a 61 Spool Rigid Strander composed of 6-12-18-24 spool sections and a 72″ diameter capstan.

Each spool section is equipped with anti-friction bearings, solenoid brakes, large diameter wire guide sheaves, quick acting spool locks, reversible mechanism, speed change and stop motions.

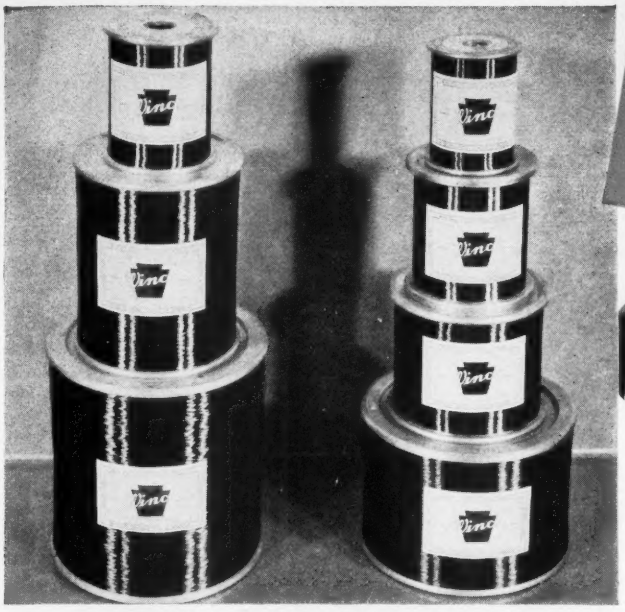
The 61 Spool Strander is driven by a 20-HP motor through a silent chain drive to an anti-friction line shaft which extends the entire length of the machine. All gearing and rotating spool sections guarded.

We build these machines in any combination.

Prices furnished on request.

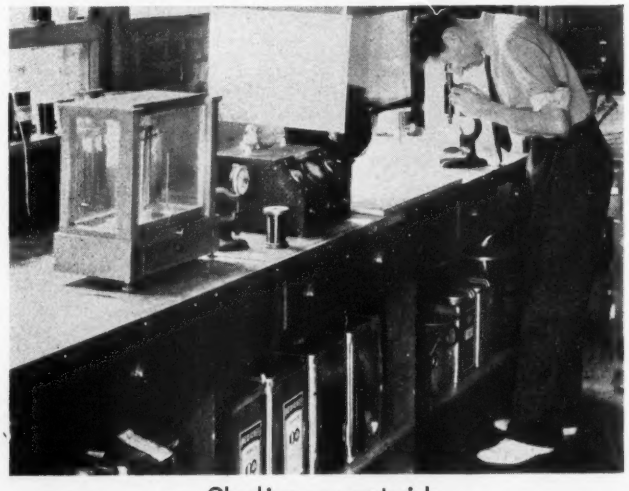
NEW ENGLAND BUTT COMPANY

PROVIDENCE, RHODE ISLAND, U. S. A.



Custom built spools for high speed winding

Mercury testing for continuity of film



Checking raw materials

Don't "fool around"... USE DEPENDABLE WIRE PRODUCTS!

A product, too, is only as strong as its weakest part. Follow the practice of leading designers and engineers by specifying only service-giving wire . . . wire that has built up a reputation for "delivering the goods under fire."

Hudson Wire products, designed for discriminating manufacturers, has just such a reputation in the fine wire field. Offering greater flexibility and tensile strength, perfect laying at higher speeds, new coating methods and reduced coil dimensions without sacrificing electrical values, Hudson Wire products will probably lower your production costs considerably. Check these three points:

QUALITY— All phases of manufacture, from ingot to final processing, are carefully supervised and fulfilled in the same manner you would carry out in your own plant. There are no unimportant phases in the work.

UNIFORMITY — By mercury process tests, our engineers can guarantee perfect uniformity in wire; from the smallest to the largest order. No more variations in consistency, structure or electrical properties . . . every inch of wire exactly as specified, more than meeting your requirements.

SERVICE—If you have a wire problem, our complete design and engineering facilities are at your disposal without obligation. Send your specifications and blueprints for our recommendations; or if you are not quite ready, write for samples of these quality products.

Enameled Copper, Enameled Iron, Enameled Alloy, Enameled Aluminum, Silk Covered, Cotton Covered, Celanese Covered, Glass Fibre Covered, Twisted Multiples, Parallel Multiples and Litzendraht.

HUDSON WIRE CO.

Winsted Division

WINSTED CONNECTICUT

CONVENTION GREETINGS

STANDARD INDUSTRIAL COMPOUNDS joins with its fellows in the Wire and Wire Products Industry of the Central West in welcoming the Wire Association Annual Convention to Chicago, October 18th to 22nd. We hope to prove ourselves good hosts on this important occasion.

STANDARD has prepared a first complete listing of its Formulas in the Wire and Metal Drawing Lubrication, Cleaning and Rust Prevention field. This will be ready for distribution shortly before and at the Convention. We cordially welcome you and look forward to personally greeting you at this coming gathering.

Standardize with Standard

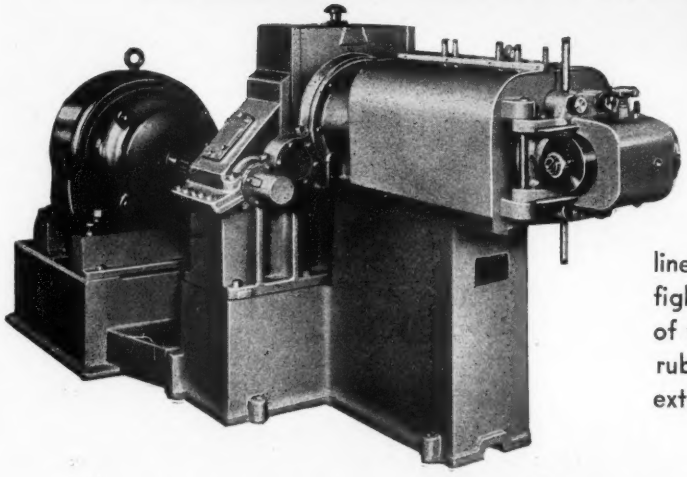
Standardize with Standard

MANUFACTURING PLANT AND LABORATORY, 4600 W. FERDINAND ST.

STANDARD INDUSTRIAL COMPOUNDS CO. . . . CHICAGO 44, ILLINOIS

UNCLE SAM'S SUBMARINES, TOO, DEPEND ON COVERED WIRE

—Official Navy Photo



The intricate system of interior communication and power transmission lines, required for the maneuvering and fighting of submarines, is largely composed of wires covered with rubber or plastics by extrusion.

Let's Work and Fight for the Free America We Lov-

ROYLE EXTRUDERS FOR WIRE COVERING

produce an important share of the covered wire used by the Navy and other branches of the armed forces of the country, as they will continue to do for every purpose when peace is again achieved.

JOHN ROYLE & SONS

BUILDERS OF A LINE OF GREAT EX TRUDERS FOR RUBBER AND PLASTICS

ROYLE
PATERSON
N.J.

AKRON, OHIO
Represented by J. C. CLINEFELTER
UNIVERSITY 3726

LONDON, ENG.
Represented by JAMES DAY
(MACHINERY) LTD.

IT'S WHAT "GETS THERE" THAT COUNTS!

AMERICAN gunners are the most accurate in the world. Their death packed projectiles are delivered with a punch that counts. Why? It's firepower . . . DIRECTED! Over miles of wire strung by the courageous Signal Corps flows the vital information that keeps our gunners "on the beam" . . . and to help maintain our forces in the field many more lines of communications will be needed. In making the material to supply this need, nearly all producers of lead encased cable in the United States and Canada use Robertson lead encasing equipment. Robertson presses, die-blocks, operating valves and lead melting pots, as well as hydraulic pumps, make complete installations in the plants of the majority of cable manufacturers.

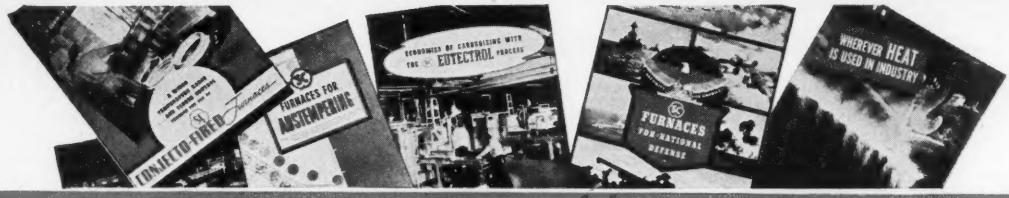
FREE Bulletins which completely describe Robertson Cable Lead Encasing Equipment and its many advantages are available when requested on your letterhead. Or, if you have any specific problem involving the maintenance, conversion, installation or repair of your encasing equipment, consult our engineering department. They'll be glad to help.

Established 1858

ROBERTSON

John Robertson Co., Inc.
125-37 Water St.
Brooklyn 1, N. Y.

Designers and builders of Lead Encasing Machines and Hydraulic Equipment, Including Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Hydro-Pneumatic Accumulators, Lead Sheath Stripping Machines, and Special Equipment for Special Uses.


TONJETTO-FIRED Furnaces
FURNACES FOR AUSTEMPERING
ECONOMIES OF CARBURIZING WITH THE EUTECTROL PROCESS
FURNACES FOR NATIONAL DEFENSE
WHEREVER HEAT IS USED IN INDUSTRY

for "swords" or "plowshares"

Annealing and Stress Relieving of CARTRIDGE CASES
Controlled Atmosphere ROLLER HEARTH FURNACES
ROTARY
HEATING AND HEAT TREATMENT OF ORDNANCE
HEAT IS USED IN THE PRODUCTION OF SHIPS, TANKS AND PLANES
WAR PRODUCTION WITH SC STANDARD RATED HEAT TREATING FURNACES
FORGING, HEATING AND HEAT TREATING BOMBS AND PROJECTILES
FORCED CONVECTION FURNACES
SURFACE COMBUSTION HARDENING FURNACES
ANNEALING AND NORMALIZING IN SURFACE COMBUSTION FURNACES
SC Batch Type GAS CARBURIZING FURNACES
SURFACE COMBUSTION - TOLEDO
SC STANDARD RATED INDUSTRIAL FURNACES
Modern MALLEABLEIZING IN SURFACE COMBUSTION FURNACES
Surface Combustion Draw Furnaces CONVECTION AND DIRECT-FIRED TYPES
SURFACE COMBUSTION - TOLEDO
SC
Continuous Type GAS CARBURIZING FURNACES
Surface Combustion - Toledo, Ohio
The SC Primer of Prepared Atmospheres
HEAT TREATMENT AND HEAT TREATMENT COPPER BRASS
SC

Today, Surface Combustion Heat Treat Engineers literally live with the metal working industry.

Veterans of peace and war-time heat treating, these men have made themselves expert in industry's heat treating needs. Their assignment is to see to it that there are Surface Combustion Furnaces to meet any requirements, large or small.

Surface Combustion Engineering Service goes much farther than that. Long to the forefront in applying heating in industrial problems, Surface Combustion has become a responsible clearing house on the heat treatment of both products for armament and for civilian use. Its great fund of information on metals processing grows steadily larger. Continuing study and research perfect treatment of new metals, advance new treatments for old ones. Surface Combustion Engineers are called in to help set-up new methods. And, when new ones arise, Surface Combustion usually has or can readily furnish the type of heating or heat treating equipment it takes.

Surface Combustion's contribution to modern heat treat problems covers applications "for swords or for plowshares". Whatever your problem—let us work with you.

SURFACE COMBUSTION
TOLEDO, OHIO

SURFACE COMBUSTION

Syncro developments fo
will be eq

SYNCRO

The meaning of this symbol

The name Syncro was adopted by the Syncro Machine Company because its first product was an entirely new type of gearless flyer serving machine, employing electrically synchronized flyer, capstan and take-up motors.

Today, Syncro manufactures a complete line of wire and cable processing machinery, automatic synchronized mechanical and electrical signal controls for this machinery and special purpose machines of various types for the wire industry.

But most important to you is the fact that the Syncro symbol means that every machine bearing it incorporates the modern design, the skilled engineering and workmanship that assures economical, dependable and efficient production

S
R

...s for the war effort ...e equally valuable in

POST WAR RECONSTRUCTION

The urgency of the need for huge quantities of wire and cable for the war effort has greatly advanced Syncro research and development work. For, to produce the wire and cable in the quantities needed, processing machinery had to be made available which would reach new levels of efficiency, economy and dependability. And for many special purposes, machinery of entirely new design was required.

Syncro has pioneered in this development work and the Syncro machines that are so capably fulfilling war needs now, will be equally valuable in processing wire and cable, economically, dependably and efficiently, in the reconstruction period which will follow the United Nations' victory.

SYNCRO MACHINE COMPANY

RAHWAY NEW JERSEY

Looking for Information?

Need a little help on that metal problem of yours?

Want to speed up production of some particular war product, or see if you can save some metal somewhere along the production front?

Then come to Chicago the week of October 18 and attend the National Metal Congress and War Conference Display. Devoted to increased production of war products, to conservation of materials, and to post-war planning, this great event of the metal industry will help you solve many problems.

More than a hundred technical lectures will be presented by the four cooperating societies. Leaders in the metal industry and government will participate in the special War Production and Conservation Sessions held each day by the American Society for Metals, sponsor of the event.

We've a big production job still ahead of us. We need all the information and new developments that will improve the efficiency of armament production. So mark your calendar now — and plan to be in Chicago when the metal industry meets the week of October 18.

THE PALMER HOUSE
Chicago - October 18 thru 22

NATIONAL METAL CONGRESS and WAR CONFERENCE DISPLAY

● **Thousands of visitors to the Metal Congress will look to the hundreds of War Conference Displays for new products, new processes, and new developments. 65% of the available display space has been reserved in the first four weeks following announcement of this 25th Annual Conference Display.**

But excellent display room locations are still available. For complete information, write or wire the American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio. Phone: ENdicott 1910.

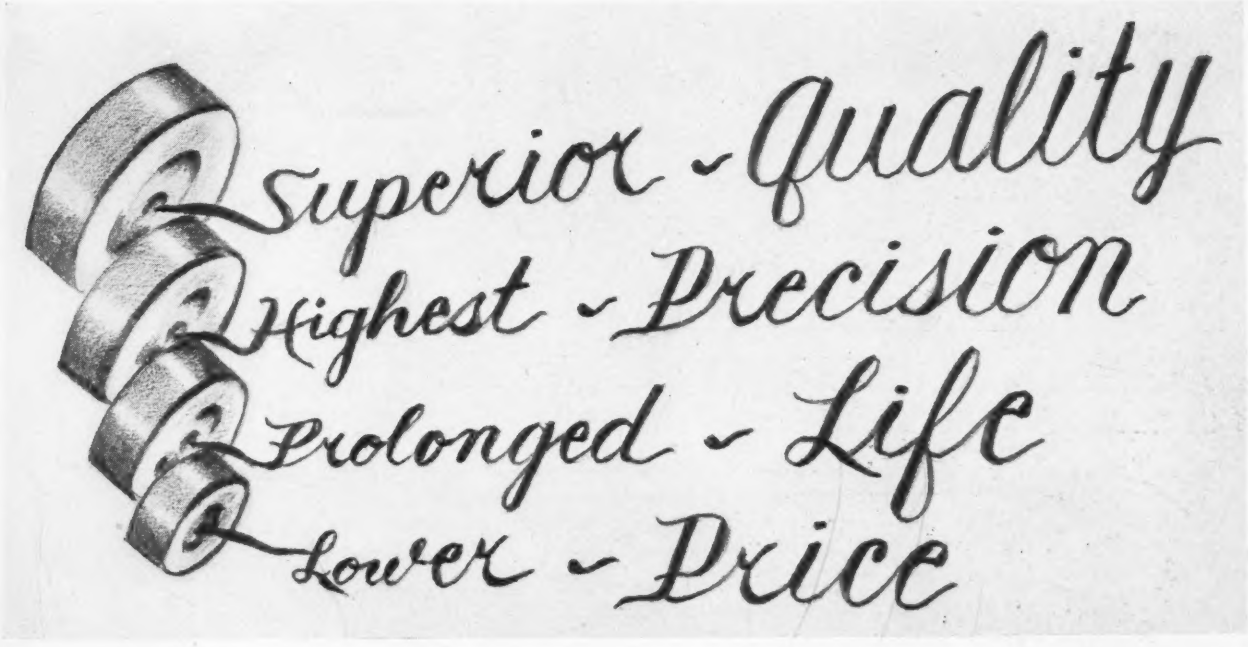
NATIONAL METAL CONGRESS AND WAR CONFERENCE DISPLAY

Under the direction of the American Society for Metals, in cooperation with the American Welding Society, the Wire Association, and the Institute of Metals and Iron and Steel divisions of the American Institute of Mining and Metallurgical Engineers.

FREE
FROM
BLOWHOLES

FREE
FROM
BRITTLENESS

TUNGSTEN CARBIDE DIES greatly improved are now produced under our own patents by means of latest methods. Continuous research and pioneering have developed advance standards of quality. Our research staff will help solve your production problem and keep you informed of new developments and patents in your field. You are invited to avail yourself of this service.



MASTER WIRE DIE CORPORATION

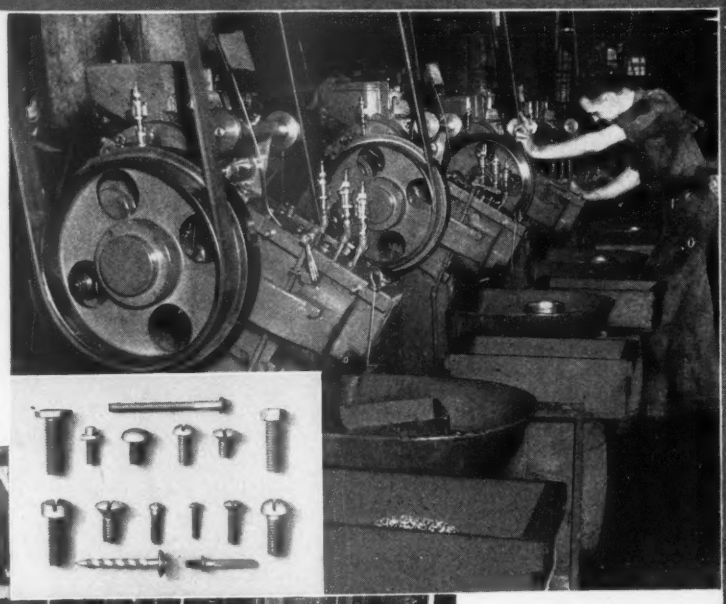
250 East 43rd Street — New York, N. Y.

Makers of Wire, Tube, Rod, Shell, Shaped,
Extrusion and Cold Heading Dies

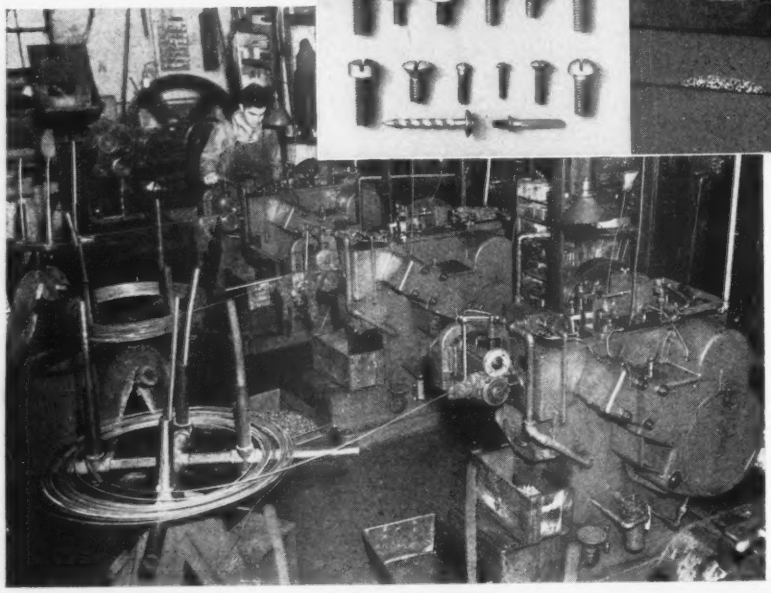
Telephone: MUrray Hill 4-4753

Machine Screws

By the million



Right. Each machine in this battery of Waterbury-Farrel Automatic Screw Thread Rollers will do more than 1,000,000 No. 10 machine screws a month. These machines are available in sizes up to and including ¾".



Left. The latest in High Speed Cold Headers—a group of Waterbury-Farrel "Hi-Pro" Double Blow Headers. Production: $\frac{3}{16}$"—225 per min; $\frac{5}{16}$"—175 per min.

Produced on WATERBURY-FARREL COLD PROCESS SCREW MACHINERY *at the* CENTRAL SCREW CO., PLANT

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 18 OCTOBER 1943 No. 10

Designated as

Official Publication By The Wire Association

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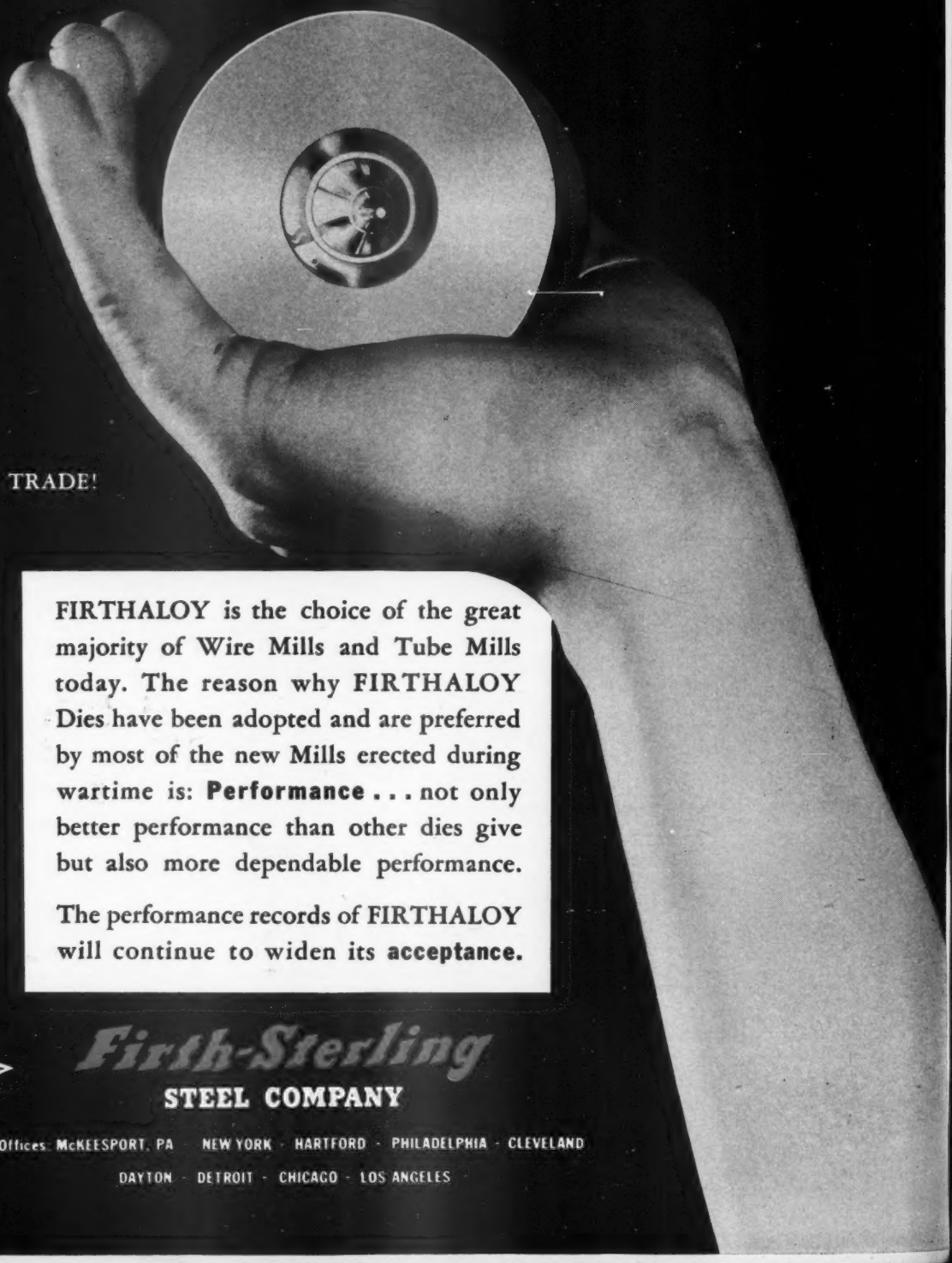

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Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 18 OCTOBER, 1943 No. 10

The Graphical Solution of Wire Mill Mathematical Problems

By E. J. Crum,

General Foreman, Bethanizing and Galvanizing Departments.
Bethlehem Steel Company, Sparrows Point, Maryland.

AN old saying, attributed to the Chinese, contends that a picture is worth ten thousand words. This saying, when applied to graphical charts, which are really pictures of mathematical formulas, is a gross understatement. It is possible for one chart to show many times ten thousand different combinations of the variables in the formula which it represents.

✦ ✦ ✦

SUCH charts have long been used by engineers and others when it has been necessary for them to use the same formula over and over again. Many hours of the monotonous labor of computation can thus be saved by using this convenient method.

✦ ✦ ✦

ALTHOUGH some graphical methods are used in the wire industry, it is the opinion of the author that the practical utility of this method of calculation is not generally appreciated.

The purpose of this paper is to better acquaint wire mill men with labor saving methods available through graphical calculations. It is hoped that the set of charts presented here will be of pertinent value in the solution of some of the more common wire mill problems. ✦ ✦ ✦ ✦ ✦

E. J. CRUM

E. J. Crum was born in Virginia, Illinois, January 5th, 1909. Graduated from Missouri School of Mines in 1929 with a B.S. in Metallurgical Engineering. Entered the employ of Bethlehem Steel Company in 1929. Engaged in experimental and development work on Bethanized wire from 1933 to 1937 at which time he became General Foreman of Bethanizing and Galvanizing Departments, Rod and Wire Mills, Sparrows Point Plant.

Purpose

THE purpose of this paper, therefore, is to better acquaint wire mill men with these labor saving methods and to make them aware of the potentialities of graphical calculation. It is hoped that the set of charts presented here as illustrations of the various graphical methods will be of practical value in the solution of some of the more common wire mill problems.

✦ ✦ ✦

SOME of the charts presented here have been proved to be useful in the mill; others have been developed especially to illustrate a particular design. Practicability and usefulness, nevertheless, have been, at all times, the guiding factors in the determination of the type of each of the charts. In no case, however, is it claimed that the design is the exclusive nor even the best graphical method of solving that particular formula.

Designated as Official Publication by the Wire Association

THE discussion accompanying each chart is confined to the practical use of that chart in solving the formula which it represents. The theory and construction of the charts are not within the scope of this paper. To aid those who are interested in pursuing the subject further a list of reference books is appended

✦ ✦ ✦

Wire Mill Mathematics

MOST of the everyday wire mill problems are rather simple from a mathematician's point of view in that they can be fitted to standard formulas and solved with a limited knowledge of arithmetic. But, to the busy wire mill operator, interested in saving time as well as being accurate, the arithmetical processes are tedious.

✦ ✦ ✦

TO save time and insure accuracy a set of tables, a slide rule, or a combination of the two are usually made use of in the solution of formulas.

✦ ✦ ✦

EVEN these methods, however, seldom equal the speed nor simplicity of solution that can be attained by the use of an appropriate graphical chart.

✦ ✦ ✦

Advantages of Graphical Computation

THE accuracy of a graphical chart is generally comparable to that of a slide rule having the same length of scale. In the solution of the majority of wire mill formulas, accuracy of this order usually suffices.

✦ ✦ ✦

SINCE the chart and the slide rule have the same accuracy, then the advantages of the one over the other must be sought elsewhere. One advantage held by the chart is that a more rapid calculation can be made. This rapidity results from fewer settings or operations; the elimination of the necessity for the remembrance of or the reference to constants; the capacity of the chart for making additive as well as multiplicative operations at the same time; and from the fact that the variables appear on the chart in their proper units without the placement of the decimal point. For these same reasons, it is obvious that the simplicity of operation decreases the chance for error in the final result. A third, and often very important advantage, results from the fact that the chart depicts the relationship of all the variables in the formula. It is, therefore, possible for the user to visualize as well as to measure the results of a change in the value of any one of the variables.

✦ ✦ ✦

Types of Charts and Explanation Of Their Use

Chart 1:

CHART 1A and its reciprocal 1B illustrate the simplest form of the Nomographic or Alignment Chart. It is obvious that a double sided scale as used here is the fixed equivalent of an ordinary slide rule.

✦ ✦ ✦

CHART 1A shows the relationship of the weight per lineal foot and the diameter of round steel wire. It represents the formula:

$$P = 2.667\ d^2$$

where P = weight of wire in pounds per lineal foot.
d = diameter of wire in decimal inches.

The value of P for any given diameter may be read from the P scale at the point directly opposite the scale division indicating that diameter. For example, a wire with a diameter of .100 inches weighs .0267 pounds per linael foot.

✦ ✦ ✦

CHART 1B shows the relationship of the length per pound and the diameter of round steel wire. The formula is:

$$F = \frac{1}{2.667d^2} = \frac{.375}{d^2}$$

where F = length of wire in feet per pound.
d = diameter of wire in decimal inches.

Chart 2:

THE lineal speed of travel of a round wire being drawn on a cylindrical block is given by the formula:

$$S_f = .2618\ D\ S_r$$

where S_f = speed of travel in feet per minute.
D = diameter of block in inches.
S_r = speed of rotation of block in revolutions per minute.

✦ ✦ ✦

CHART 2, representing this equation, is known as an Intersection Diagram. It is constructed on ordinary cross-section paper having regular divisions. The horizontal axis forms the scale of S_r; the vertical axis, the scale of S_f. To increase the accuracy and range of the chart, two sets of graduations have been made on these scales. Five values of D (8″, 12″, 16″, 22″, 30″) are represented by the reference lines on the diagram.

✦ ✦ ✦

SUPPOSE, for example, that a twenty-two inch wire block is rotating at 200 R P.M. and we wish to find the lineal speed of the wire. On the lower scale S_r, locate the graduation 200. Follow up this line until it intersects the line marked 22″. Project horizontally from this point to the outer S_f scale and then read the speed of travel = 1150 feet per minute.

✦ ✦ ✦

Chart 3:

THE production of round steel wire from a wire-drawing block is given by the formula:

$$P = 160\ d^2\ S_f$$

where P = production in pounds per hour.
d = diameter of wire in decimal inches.
S_f = speed of wire in feet per minute.

✦ ✦ ✦

HERE in chart 3 is an example of one of the most useful graphical methods—the three line nomographical chart. The three scales, represent the three variables of the formula, are aligned

in such a way that any straight index line cutting all three of the scales will give values satisfying that formula. As shown on the chart the left hand scale represents the diameter of the wire (d); the right hand scale, the speed of travel (S_f); and the middle scale, the pounds of production per hour (P).

✦ ✦ ✦

SUPPOSE that a .200 inch diameter wire is finishing at 300 feet per minute. To determine the rate of production from the chart proceed as follows:

✦ ✦ ✦

LOCATE .200 on the d scale and 300 on the S_f scale. Connect the two points with a straight edge. Now, at the intersection of the index line with the P scale read the value of P = 1920 pounds per hour. The sample index line on the chart indicates this problem.

✦ ✦ ✦

IF the desired values of d or S_f do not fall within the range of the chart, simply change the decimal points on the scale or scales involved and on the P scale to conform.

✦ ✦ ✦

IF it is customary to express the drawing speed in terms of revolutions per minute, Chart 2 will be found useful for converting R.P.M. to feet per minute.

✦ ✦ ✦

Chart 4:

IN the drawing of round wire the percentage reduction of area from one diameter to another is given by the formula:

$$P = 100\left[1 - \frac{d^2_f}{d^2_o}\right]$$

where d_f = the final diameter in decimal inches.
d_o = the original diameter in decimal inches.
P = percentage reduction of area.

✦ ✦ ✦

CHART 4, designed to solve this formula, illustrates a variation of the three line nomograph in which the solution is obtained by two separate operations. The first operation consists of connecting a graduation on the d_o scale and a graduation on the d_f scale, representing values of the original and final diameters respectively, with a straight index line. The second operation consists of drawing, paralled to the first index line, a second index line which passes through a fixed point and cuts the P scale. The fixed point, for sake of convenience, has been located on the d_o scale at the graduation representing .207, the decimal equivalent of #5 W. & M. gauge wire. The value of the percentage reduction of area is read from the graduation at the intersection of this second index line with the P scale.

✦ ✦ ✦

PROBLEM 1: This is probably the most frequently used formula in the Wire Mill. To demonstrate the ease with which it can be solved by the chart take, for instance, a job drawing sixteen gauge wire (.062″) from a nine gauge (.148″) stock.

✦ ✦ ✦

SOLUTION 1: To determine the percentage reduction of area, first draw an index line connecting .148 on the d_o scale and .062 on the d_f scale. Now draw the second index line through the fixed point and parallel to the first index line. You will observe that the P scale is cut at P = 82.5 per cent.

✦ ✦ ✦

EQUIPMENT for Reading Charts: When using this chart or any other chart where it is necessary to draw a second index line parallel to the first, a set of two transparent celluloid triangles or a celluloid triangle and a straight edge, will be found very useful. The first index line, usually imaginary, is formed by one edge of the celluloid triangle. The triangle, with an opposite edge held firmly against the straight edge, is slid along until the first edge passes through the desired point. The second index line is then parallel to the first.

✦ ✦ ✦

PROBLEM 2: .080″ diameter wire is being drawn from .192″ wire to produce a certain set of physical properties. Suppose it is desired to find the diameter of the starting wire that would achieve the same results on .072″ finished wire.

✦ ✦ ✦

SOLUTION 2: Form the first index line to connect .192 on d_o and .080 on d_f. Now slide the triangle along until the edge passes through .072 on d_f.
Read the new value of d_o — .173″.

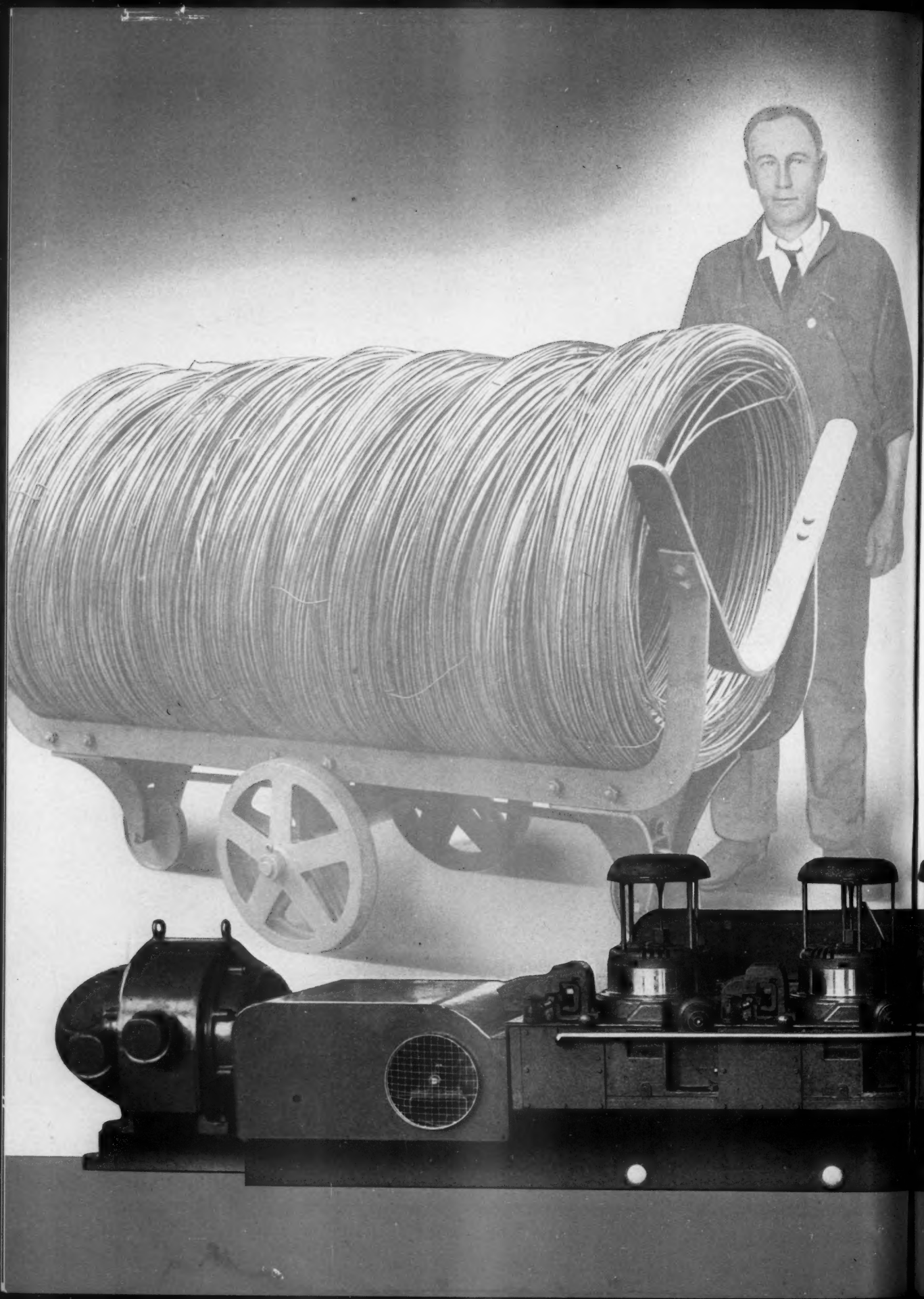
✦ ✦ ✦

Chart 5:

IN double-deck drafting the size of the bottom die is determined

INDEX TO CHARTS

CHART 1a, shows the relationship of the weight per lineal foot and the diameters of round steel wire.
CHART 1b, shows the relationship of the length per pound and the diameters of round steel wire.
CHART 2, shows the lineal speed of travel of a round wire being drawn on a cylindrical block.
CHART 3, shows the production of round steel wire from a wire drawing block.
CHART 4, shows the percentage reduction of area from one diameter to another, in the drawing of round wire.
CHART 5, shows how to determine the size of the bottom die in double-deck drafting.
CHART 6, is an all purpose wire drafting calculator designed primarily to give the intermediate die diameters on a multi-block wire drawing machine which requires all drafts to have the same percentage reduction of area. This chart has also been found useful in solving many other drawing problems.
CHART 7, shows the determination of the percentage of zinc on zinc-coated round wire.



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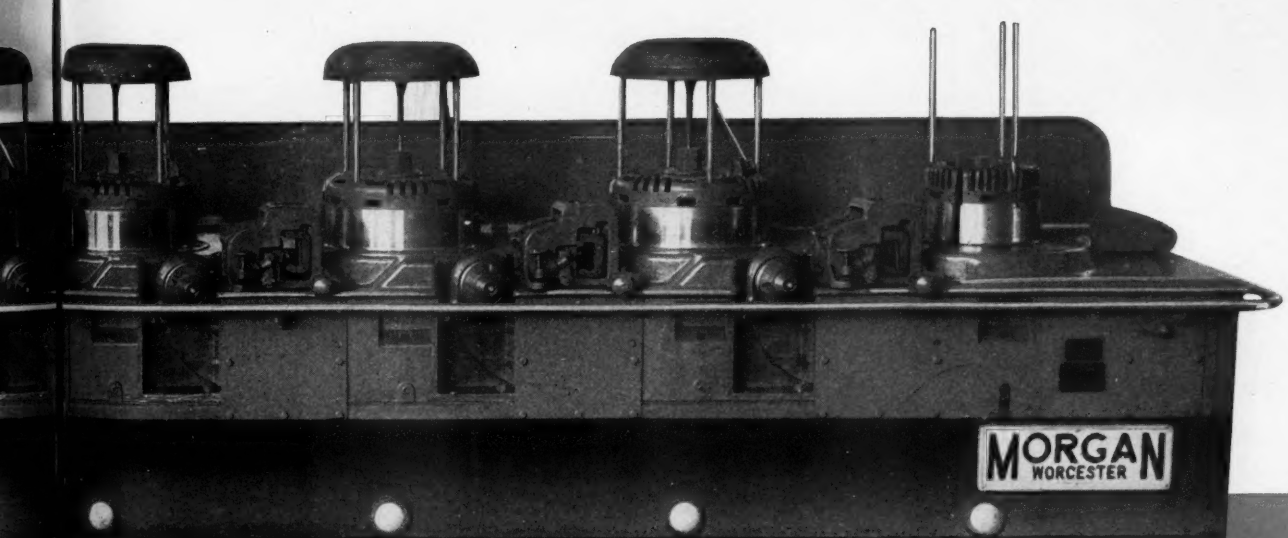
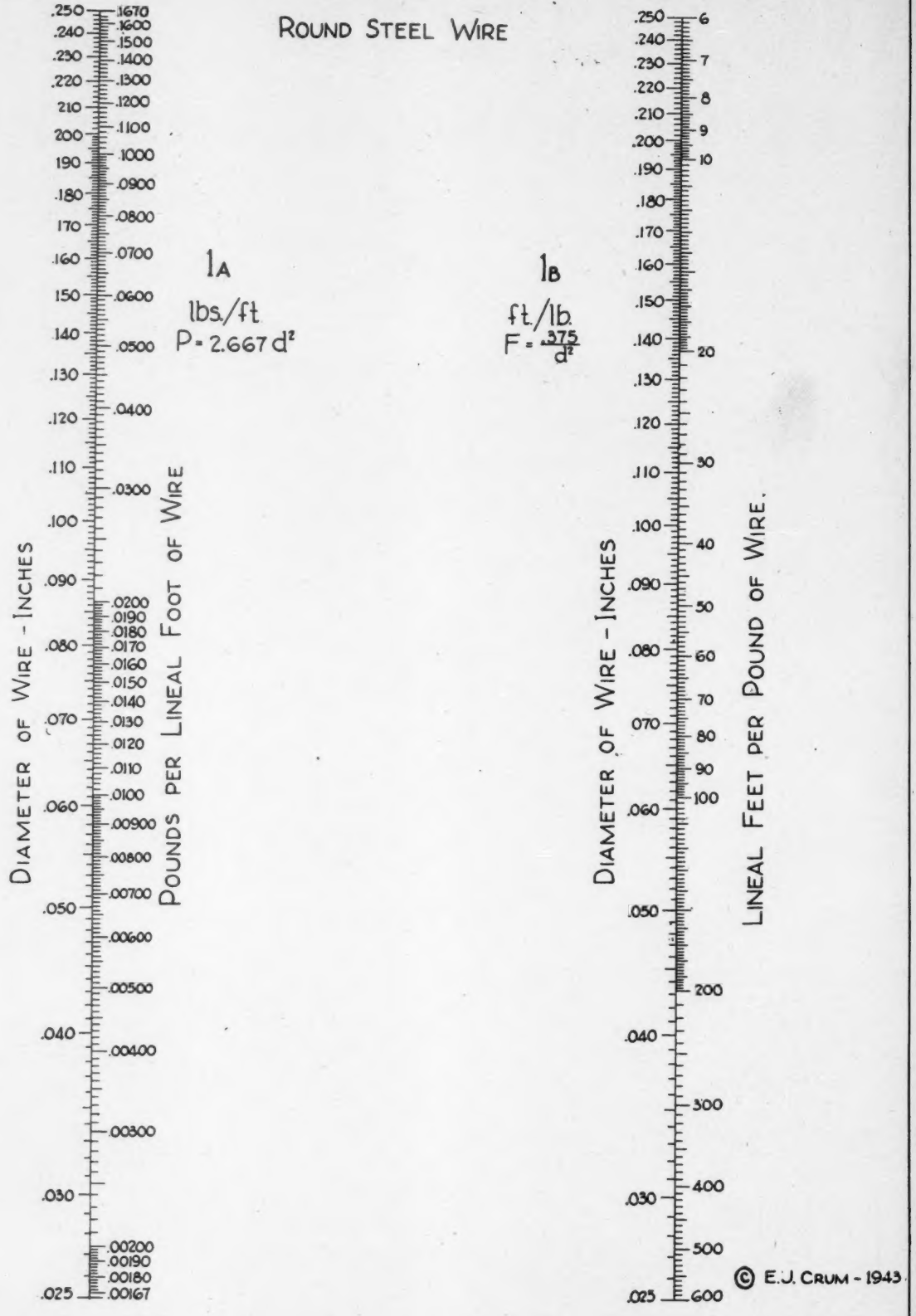


CHART 1

ROUND STEEL WIRE



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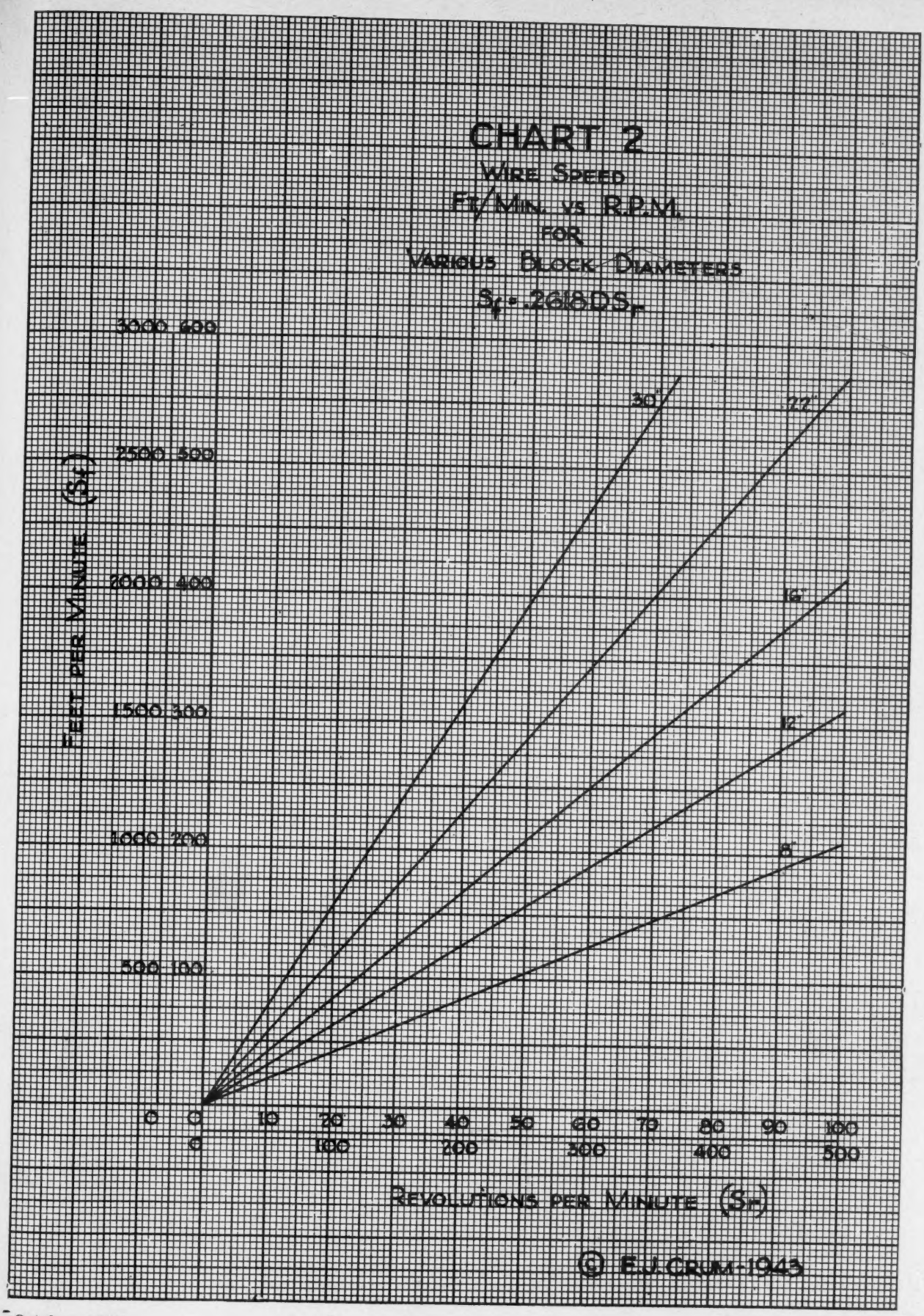
CHART 2
WIRE SPEED
FT/MIN. VS R.P.M.
FOR
VARIOUS BLOCK DIAMETERS
$S_f = .2618 D S_r$
FEET PER MINUTE (S_f)
3000 600
2500 500
2000 400
1500 300
1000 200
500 100
30"
22"
16"
12"
8"
0 0 0
10
20 100
30
40 200
50
60 300
70
80 400
90
100 500
REVOLUTIONS PER MINUTE (S_r)
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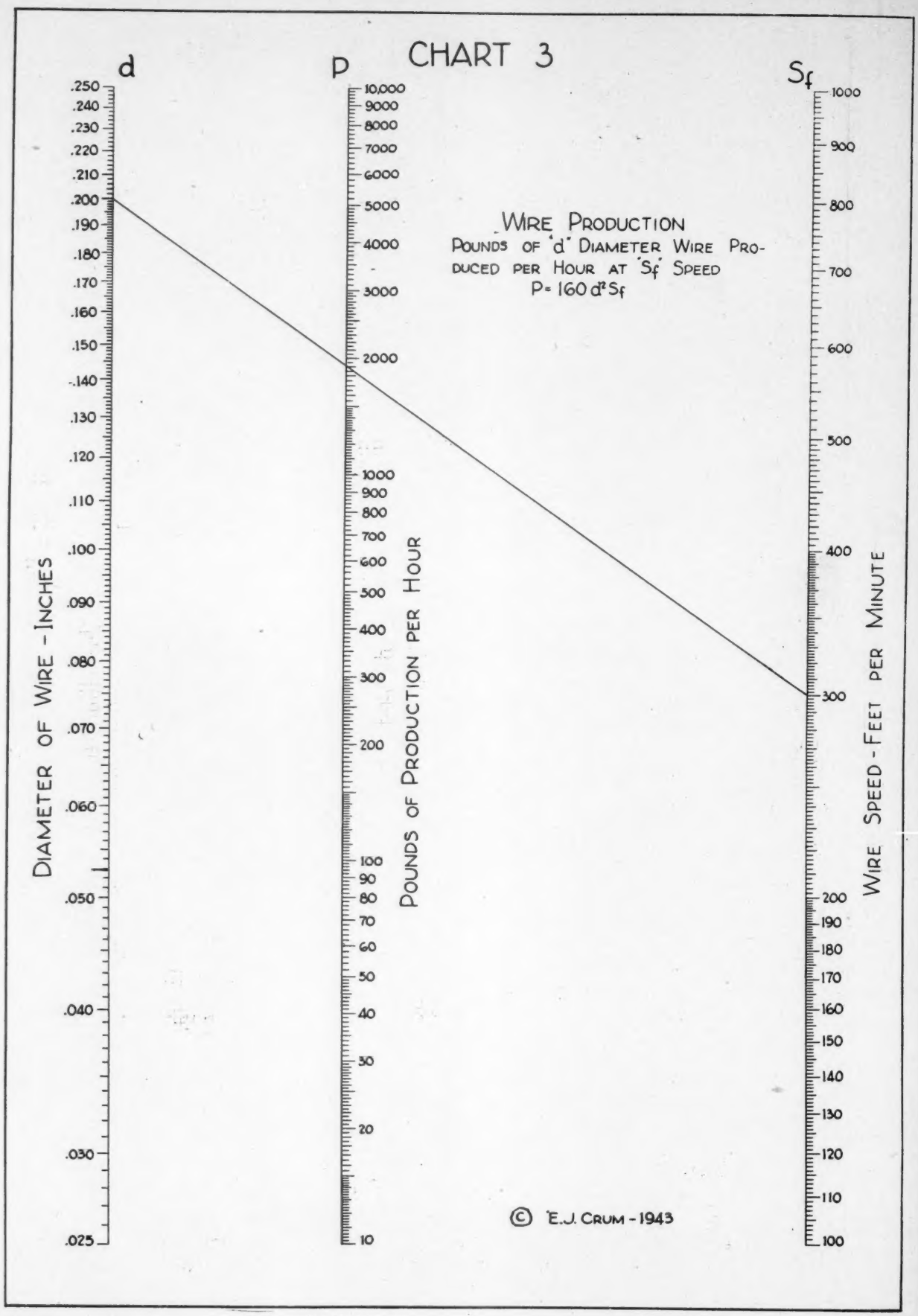
CHART 3
d
P
Sf
WIRE PRODUCTION
POUNDS OF "d" DIAMETER WIRE PRODUCED PER HOUR AT "Sf" SPEED
P = 160 d² Sf
DIAMETER OF WIRE - INCHES
.250
.240
.230
.220
.210
.200
.190
.180
.170
.160
.150
.140
.130
.120
.110
.100
.090
.080
.070
.060
.050
.040
.030
.025
POUNDS OF PRODUCTION PER HOUR
10,000
9000
8000
7000
6000
5000
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
WIRE SPEED - FEET PER MINUTE
1000
900
800
700
600
500
400
300
200
190
180
170
160
150
140
130
120
110
100
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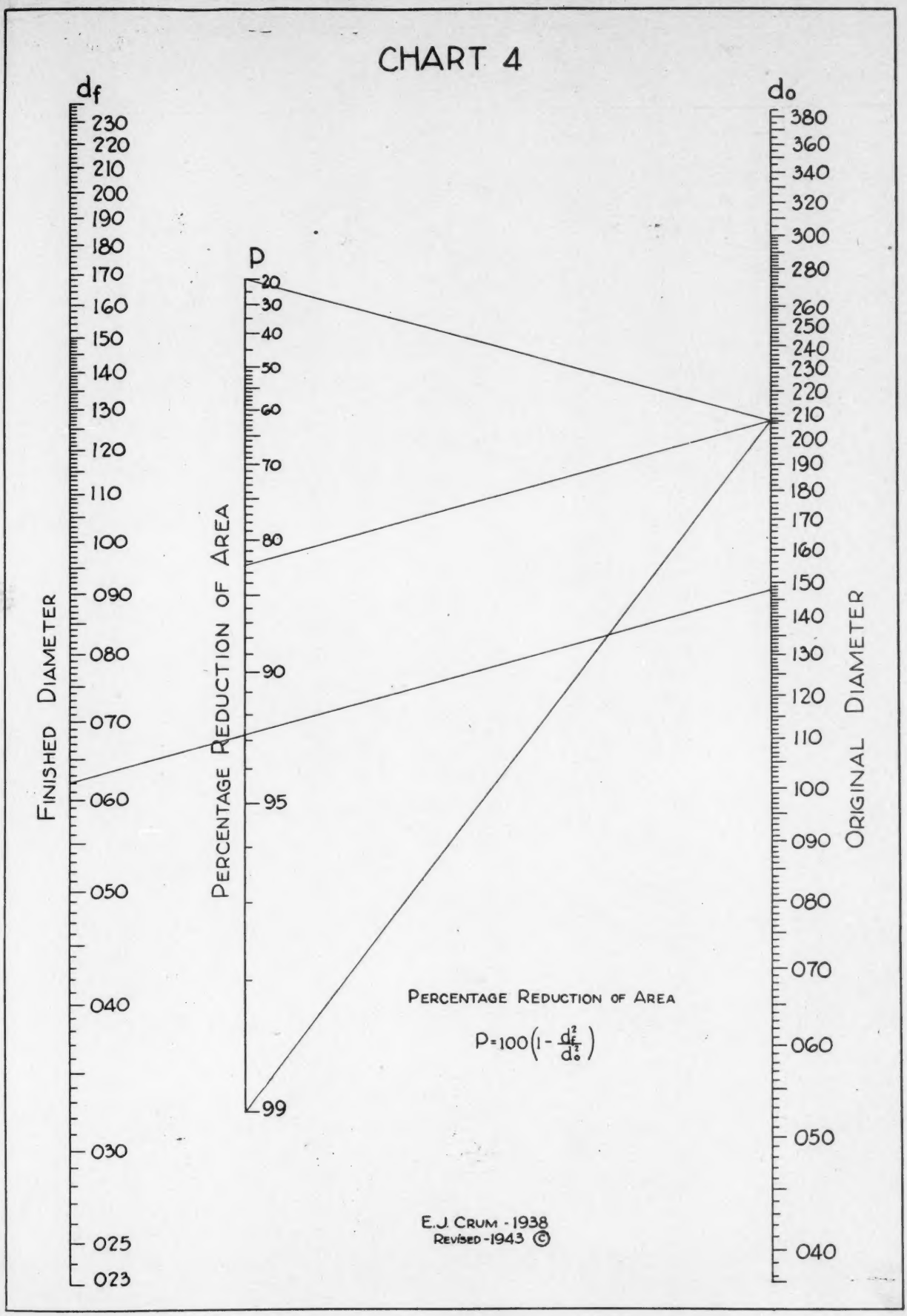
CHART 4
d_f
230
220
210
200
190
180
170
160
150
140
130
120
110
100
090
080
070
060
050
040
030
025
023
FINISHED DIAMETER
P
20
30
40
50
60
70
80
90
95
99
PERCENTAGE REDUCTION OF AREA
d_o
380
360
340
320
300
280
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
090
080
070
060
050
040
ORIGINAL DIAMETER
PERCENTAGE REDUCTION OF AREA
$P=100\left(1-\frac{d_f^2}{d_o^2}\right)$
E.J. CRUM - 1938
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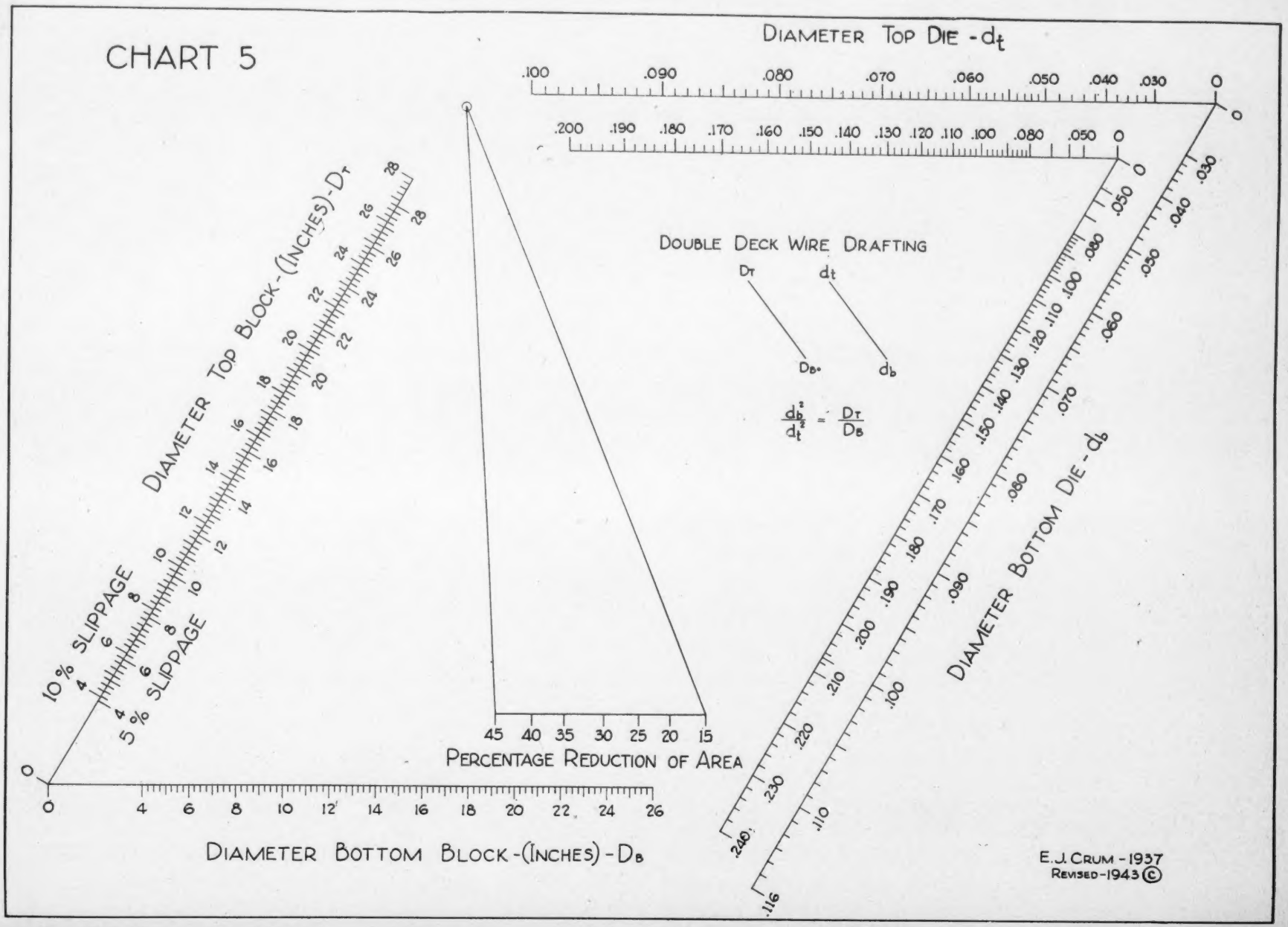
CHART 5
DIAMETER TOP DIE - d_t
.100 .090 .080 .070 .060 .050 .040 .030 0
.200 .190 .180 .170 .160 .150 .140 .130 .120 .110 .100 .080 .050 0
DOUBLE DECK WIRE DRAFTING
D_T d_t
D_B d_b
$\frac{d_b^2}{d_t^2} = \frac{D_T}{D_B}$
DIAMETER TOP BLOCK - (INCHES) - D_T
10 % SLIPPAGE
5 % SLIPPAGE
0 4 6 8 10 12 14 16 18 20 22 24 26 28
45 40 35 30 25 20 15
PERCENTAGE REDUCTION OF AREA
0 4 6 8 10 12 14 16 18 20 22 24 26
DIAMETER BOTTOM BLOCK - (INCHES) - D_B
DIAMETER BOTTOM DIE - d_b
0 .030 .040 .050 .060 .070 .080 .090 .100 .110 .116 .120 .130 .140 .150 .160 .170 .180 .190 .200 .210 .220 .230 .240
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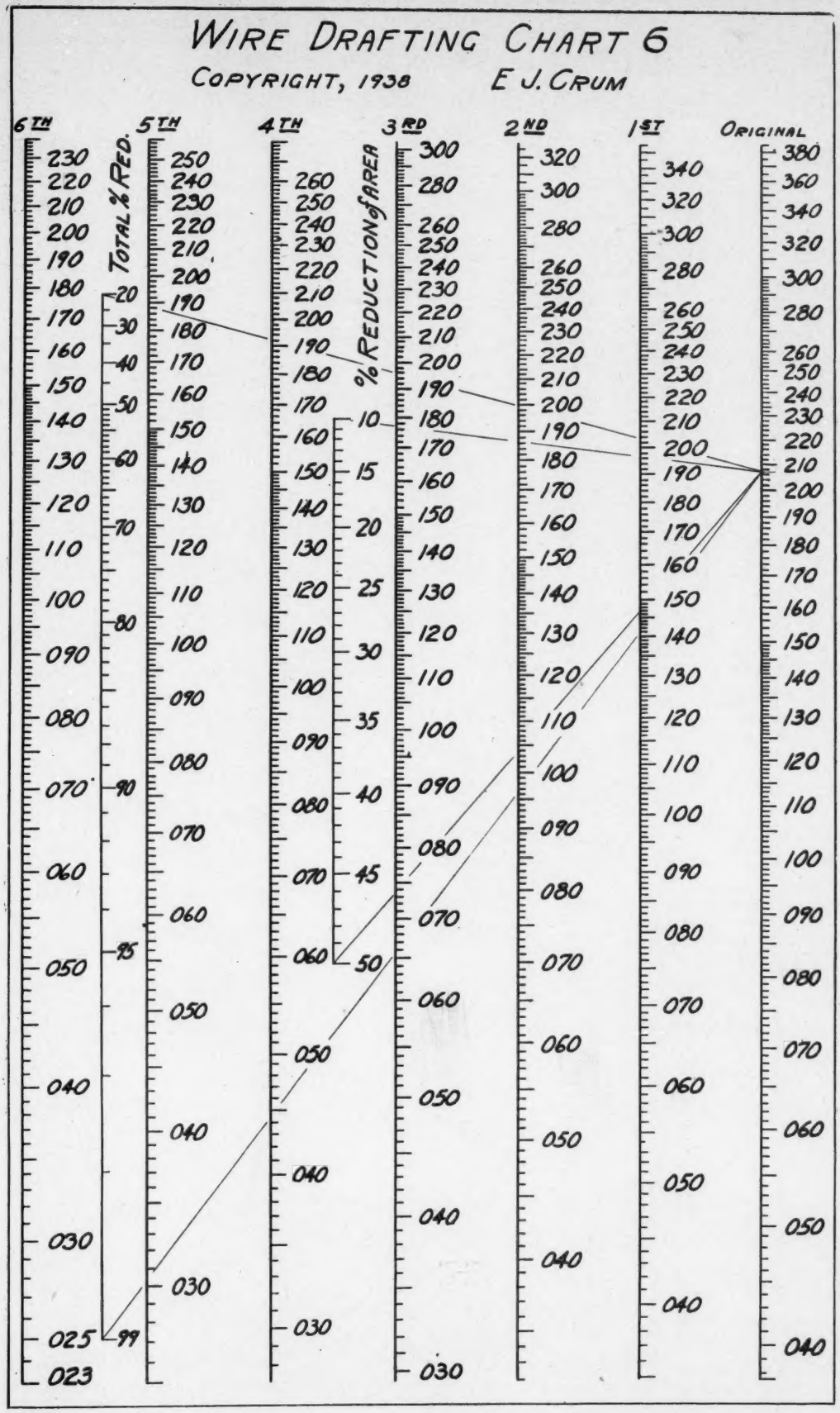
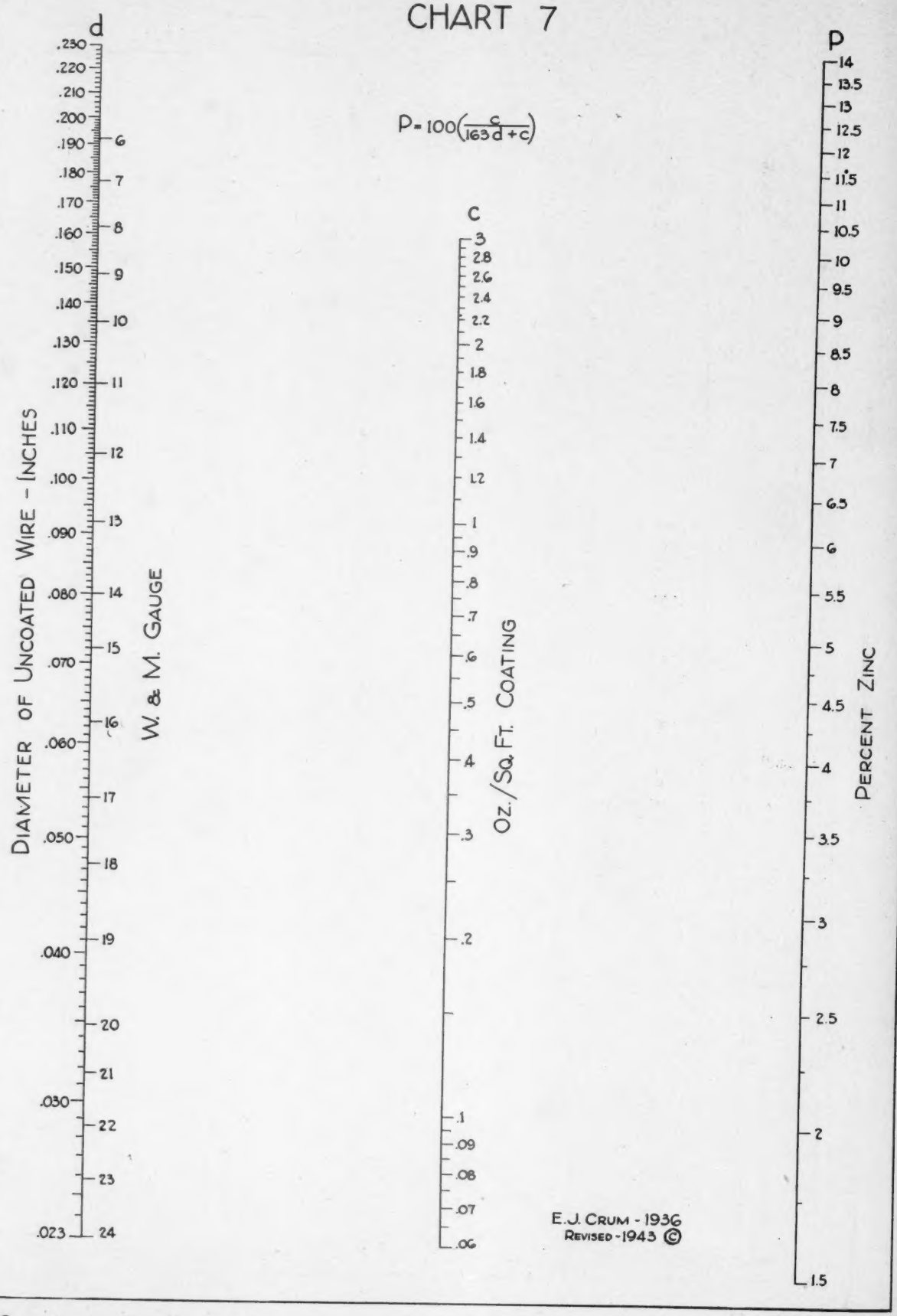
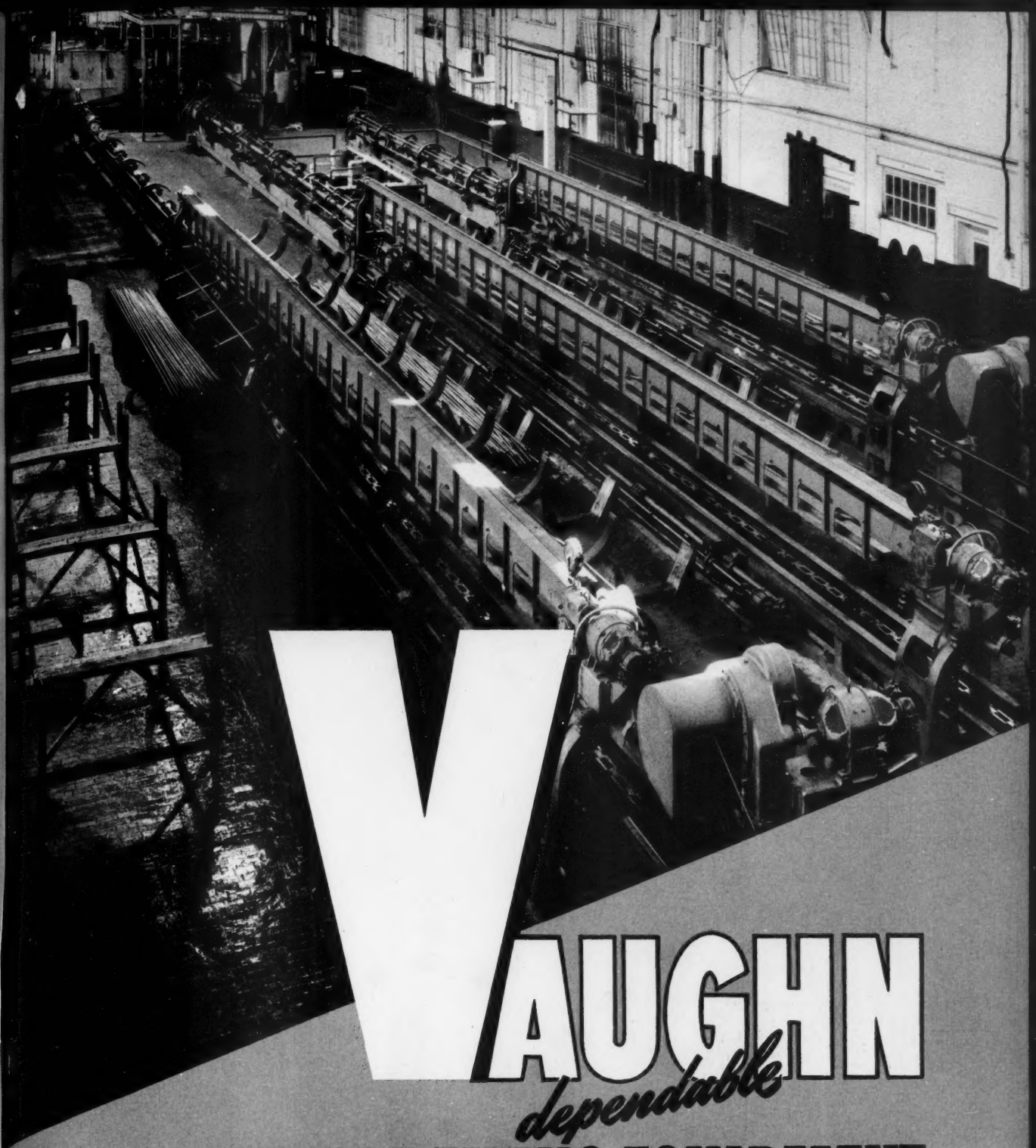

WIRE DRAFTING CHART 6
COPYRIGHT, 1938 E J. CRUM
6TH
5TH
4TH
3RD
2ND
1ST
ORIGINAL
TOTAL % RED.
% REDUCTION of AREA

CHART 7

$$P = 100\left(\frac{c}{163d + c}\right)$$





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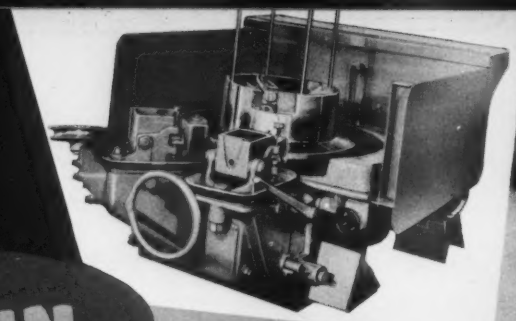

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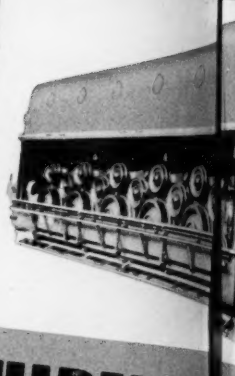
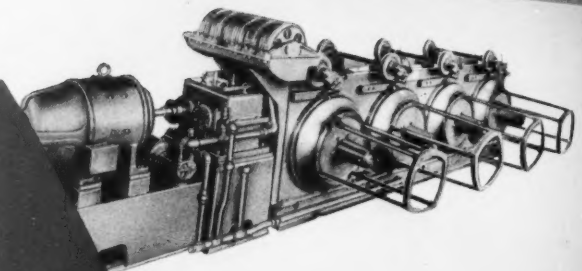
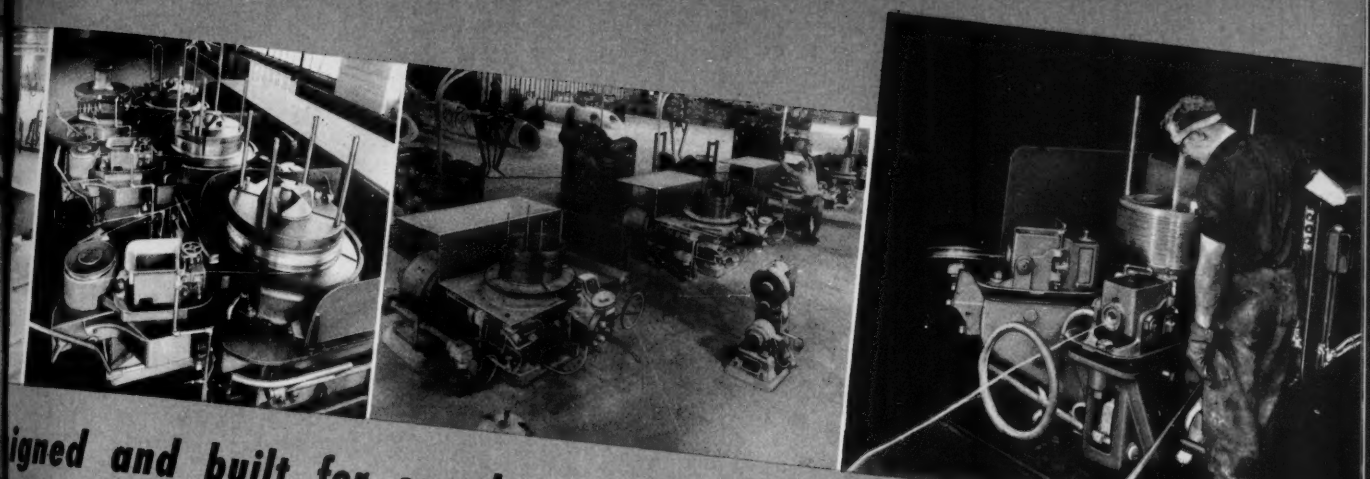




The speed and flexibility of VAUGHN Machinery anticipates *future* demands while meeting every present requirement of the wire drawing industry at war.

V



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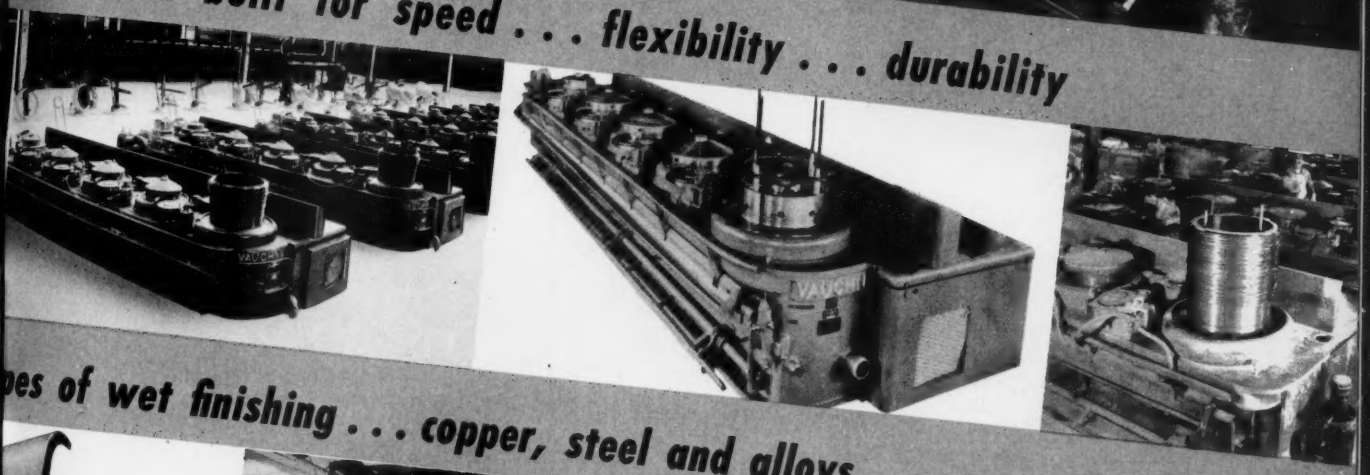

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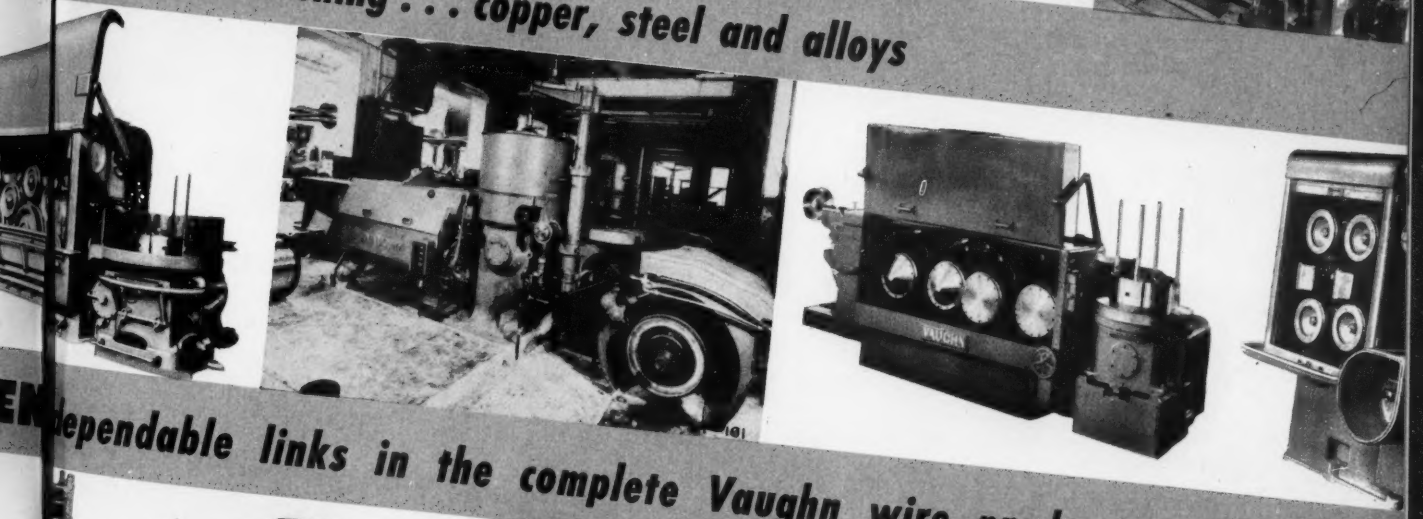

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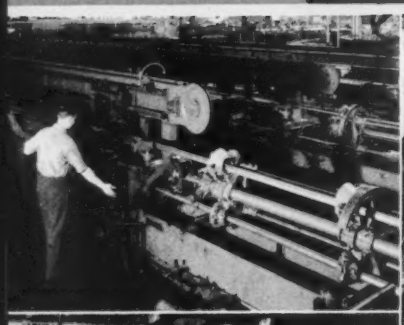

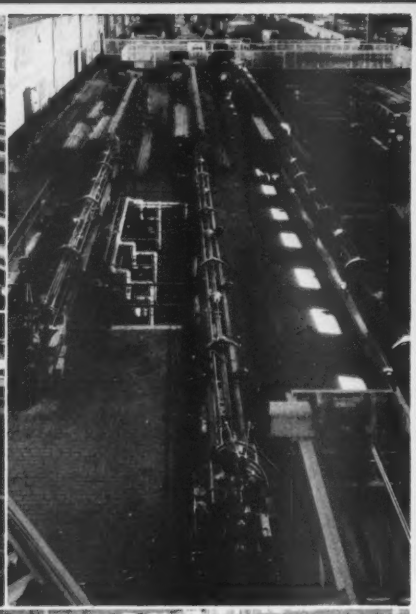

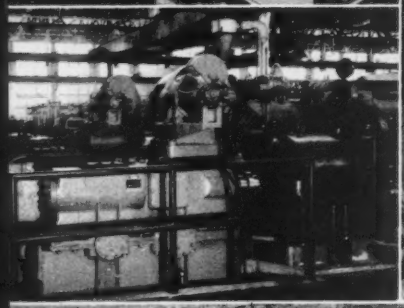

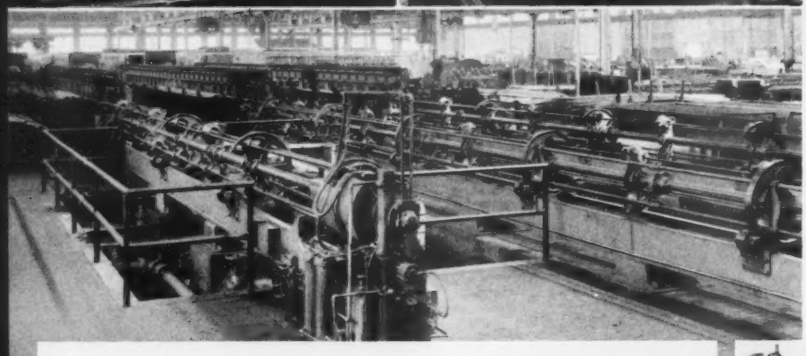

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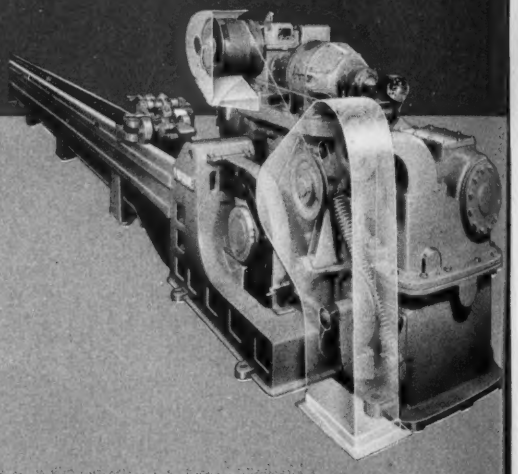

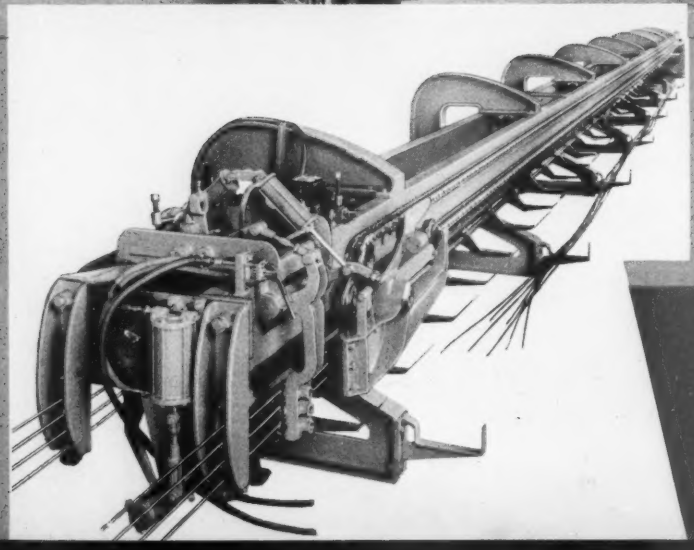

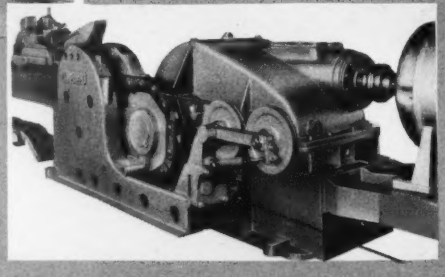

THE VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT

Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

by this formula:

$$d_b = \sqrt{\frac{d_t^2 \; D_T}{D_B}}$$

where d_b = diameter of bottom die in decimal inches.
d_t = diameter of top die in decimal inches.
D_B = diameter of bottom block in inches
D_T = diameter of top block in inches.

✦ ✦ ✦

IF a certain percentage of slippage on the bottom block is desired, the formula then becomes:

$$d_b = \sqrt{\frac{d_t^2 \; D_T \left[1 + \frac{P}{100}\right]}{D_B}}$$

✦ ✦ ✦

CHART 5, which depicts the relationship of the five variables in this formula, is a parallelogram chart. In order to see more clearly just how the chart is a picture of this formula it is better to transform the formula, thus:

$$\frac{d_b^2}{d_t^2} = \frac{D_T}{D_B} \times \left[1 + \frac{P}{100}\right]$$

✦ ✦ ✦

HERE, essentially, are two equal ratios. The two legs of the lower angle of the parallelogram represent the block diameters; the two legs of the upper angle, the die diameters. The double scale representation of the top and bottom diameters has been made to increase the accuracy of the chart. The ratio is established graphically on one angle of the parallelogram and is transferred to the opposite angle to show the relationship of the second set of variables, which exists at the same ratio.

✦ ✦ ✦

TWO values of P were used in designing the chart, the upper scale of D_T representing P = 10 per cent; the lower scale P = 5 per cent.

THE central triangular chart has nothing to do with the solution of the formula but is a separate scale which has been superimposed to indicate the percentage reduction of area of the wire through the top die.

✦ ✦ ✦

PROBLEM 1: The top and bottom block diameters of a double-deck block are 24 inches and 17 inches, respectively. This job is to be set up to finish .080" diameter wire. Assuming a 10 per cent slippage on the bottom block, calculate the bottom die size.

✦ ✦ ✦

SOLUTION 1: Using the transparent triangles as described under Chart 4, form an index line passing through 24 on the upper scale of D_T and 17 on the D_B scale. Slide the triangle along to form a second index line through .080 on the upper d_t scale and parallel to the first index line. The intersection of this second index line with the lower d_b scale gives the size of the bottom die = .100 inch.

✦ ✦ ✦

PROBLEM 2: Compute the percentage reduction of area that the top die is making in the above problem.

✦ ✦ ✦

SOLUTION 2: When the triangle is moved from one position to the other in the above solution pause and form an intermediate index line through the fixed point O, parallel to the first index line and cutting the percentage reduction of area scale of the central triangle. The intersection is read = 35 per cent.

✦ ✦ ✦

PROBLEM 3: It is desired that the bottom die make the same reduction as the top die in the above problem. What stock size should we use?

✦ ✦ ✦

SOLUTION 3: Holding the same slope as above form still another index line through .100 on the lower d_t scale and read the intersection with the upper d_b scale = .124 inch.

✦ ✦ ✦

PROBLEM 4: In designing a double-deck block it is desired that the top block have a diameter of 22 inches and that the percentage reduction of area through the top die be 30 per cent. Design the bottom block with a diameter which will allow a slippage of 10 per cent.

✦ ✦ ✦

SOLUTION 4: Form an index line with the edge of the triangle through the fixed point and the graduation 30 on the percentage reduction of area scale. Slide the triangle along until the second index line is parallel to the first and cuts the upper D_T scale at 22 inches. This index line then cuts the D_B scale at 16.75 inches—the diameter of the bottom block.

✦ ✦ ✦

Chart 6:

CHART 6 is an all-purpose wire drafting calculator. Designed, primarily, to give the intermediate die diameters on a multi-block wire drawing machine which requires all drafts to have the same percentage reduction of area, this chart has since been found useful for solving many other drawing problems.

✦ ✦ ✦

BASICALLY, the chart consists of seven* vertical, parallel scales representing the diameters of the original and subsequent wire diameters.

***As many scales as are necessary to meet the requirements of the machine may be added.**

✦ ✦ ✦

BY making use of the scales marked "Original" and "6th" and by adding the scale marked "Total o/o Red", Chart 4 has been incorporated in Chart 6. Its use is exactly the same as explained above.

✦ ✦ ✦

FORMULA: The usual procedure in calculating the intermediate die sizes required by a multi-block machine on which all drafts must be the same percent-

age reduction of area consists first of the determination of the numerical value of the percentage reduction per draft by this formula:

$$P = 100 \times \left[1 - \sqrt[N]{\frac{d_f^2}{d_o^2}} \right]$$

where P = percentage reduction of area per draft.
d_f = diameter of finished wire in decimal inches.
d_o = diameter of original stock in decimal inches.
N = number of drafts.

The percentage, thus learned, is then applied to the original stock size to determine the first die size; to the first die size, to determine the second; and so on until the final size is reached. With this method any error made in the original or subsequent calculations is accumulative and it is therefore often necessary to recalculate or adjust the intermediate sizes in order that there be no discrepancy between the final size as calculated and as desired.

✦ ✦ ✦

ALL of this tedious calculation can be dispensed with when graphical methods are used. Furthermore, the chance for accumulative error is eliminated. To determine the intermediate die sizes with Chart 6, simply form an index line from the original size on the right hand scale to the finished size on the appropriate finish scale and read the intersections of that line with the intermediate scales. The percentage reduction of area per draft and overall from original to finish can be determined in the same manner as described under Chart 4.

✦ ✦ ✦

PROBLEM 1: A six-block continuous machine is to be set up to draw sixteen gauge (.062″ dia.) wire from eight gauge (.162″ dia.) stock. Figure the intermediate die sizes.

✦ ✦ ✦

SOLUTION 1: Place one edge of the transparent triangle on the chart in such a way that it cuts the scale marked "Original" at .162 and the scale "6th" at .062. Read the intersections of this index line with the intermediate scales—

1st dia. = .138
2nd dia. = .1175
3rd dia. = .100
4th dia. = .085
5th dia. = .073

To determine the percentage reduction of area pass a second index line through the fixed point .207 on the original scale and parallel to the first index line. The intersection of this second index line with the scale marked "% Reduction of Area" gives the value of 27.7 per cent per draft. The intersection of the same index line with the scale marked "Total Reduction" gives the value of the overall reduction of area equal to 85.5 per cent.

✦ ✦ ✦

PROBLEM 2: A production specification calls for drawing fourteen gauge (.080″ dia.) wire from eight gauge (.162″ dia.) stock with no single draft exceeding 25 per cent reduction of area. Suppose that we wish to know the least possible number of drafts that can be used.

✦ ✦ ✦

SOLUTION 2: Form an index line with the transparent triangle through the fixed point and the graduation 25 on the "Percentage Reduction of Area" scale. Now slide the triangle down until the second index line, parallel to the first, passes through .162 on the "Original" scale. Examine each of the intermediate scales until .080 is is found to be on or above the index line. This condition occurs on the "5th" scale. Therefore, at least five drafts must be made to fulfill the specification.

✦ ✦ ✦

PROBLEM 3: A five-block continuous machine is to be set up on twelve gauge (.105″ dia.) wire with no single draft to exceed 30 per cent reduction of area. Determine the largest stock size that can be used.

SOLUTION 3: Using the triangle, set the first index line on 30 per cent reduction of area per draft. Slide the triangle along until the second index line, parallel to the first, passes through .105 on scale "5th". Now read the intersection of this second index line with the "Original" scale. The maximum stock size should be .255 inches.

✦ ✦ ✦

VARIATIONS of Chart 6: A number of mechanized versions of Chart 6 have been developed to facilitate its use. Although they do not differ from the chart in principle nor accuracy, the mechanized charts are usually speedier to operate. One such mechanized version is described in U. S. Patent #2, 2.307,534 recently issued to A. A. Olson.

✦ ✦ ✦

Chart 7:

THE percentage of zinc on zinc-coated round wire is given by the formula:

$$P = 100 \times \left[\frac{C}{163d + C} \right]$$

where P = per cent of zinc on the product.
d = diameter of uncoated wire in decimal inches.
C = coating on wire in ounces per square foot.

✦ ✦ ✦

CHART 7, designed originally to give the percentage of zinc on zinc-coated wire has since been found useful in determining the weight of coating required on stock for redrawing to a finer size which must meet a coating specification. These two uses will be illustrated in the sample problems.

✦ ✦ ✦

PROBLEM 1: We may wish, for example, to ascertain the percentage of zinc on a thirteen gauge steel wire having a coating of 2.4 ounces of zinc per square foot of surface.

(*Please turn to Page 666*)

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the Standard Carbide

for nail mills

More **nail mills** are now being added to the list of FIRTHALOY Users. We are glad to announce that we are again in position to extend FIRTHALOY advantages and savings to additional nail mills.

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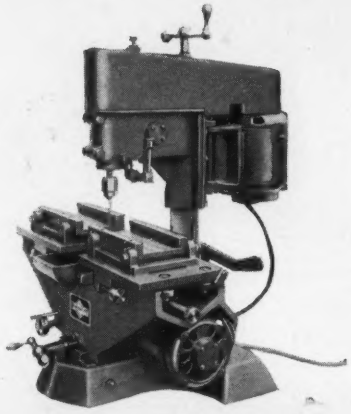

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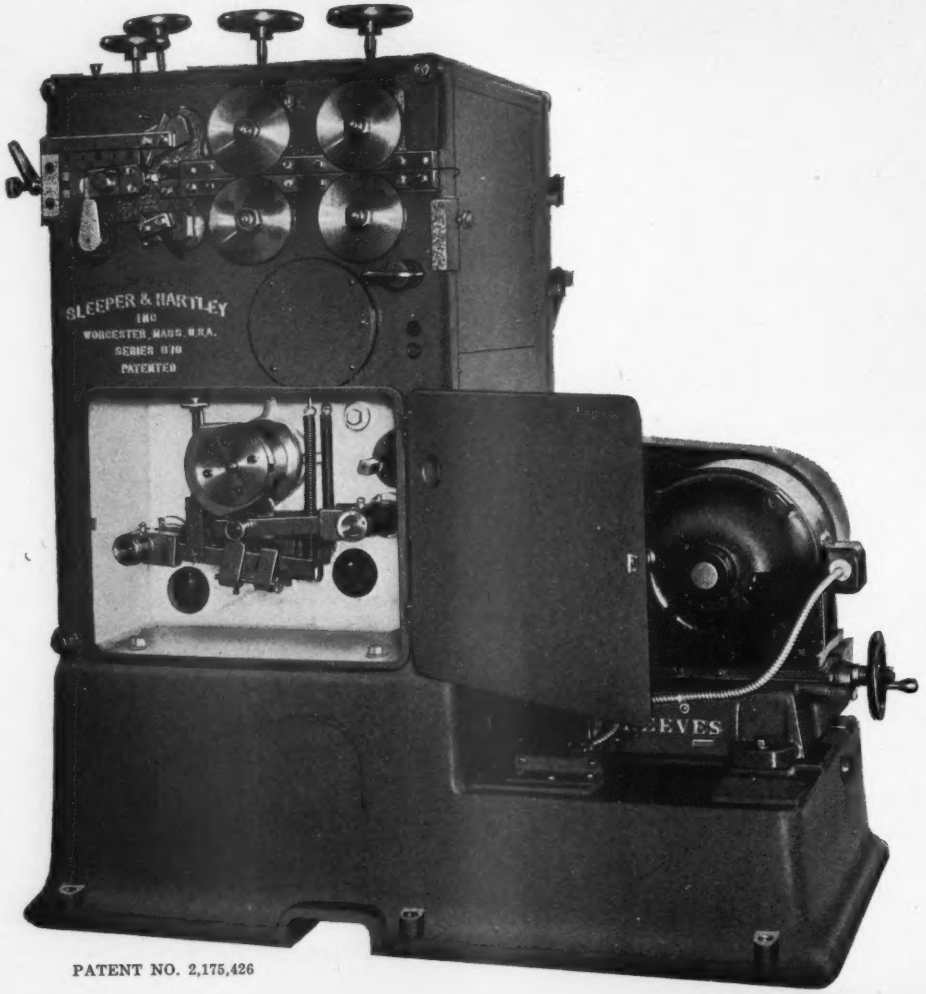
No. 1½
Universal Spring Coiler
56" Model - Series 676
SEGMENT TYPE



PATENT NO. 2,175,426

SLEEPER & HARTLEY, Incorporated
Worcester, Massachusetts, U. S. A.

Drawing High Speed Rope Wire

By John C. Aiken,
Asst. Supt., Rod & Wire Mills,
Jones & Laughlin Steel Corp., Aliquippa, Penna.

A description of some practices for drawing rope wire at higher speeds through the use of the continuous machine and setting forth methods for satisfactorily meeting rigid tensile and torsion requirements. ✦ ✦ ✦ ✦ ✦ ✦

UNDOUBTEDLY, the most important single improvement and aid to the Wire Drawing Industry in recent years has been the perfection of the sintered carbide die, and its almost universal adoption in drawing all kinds and grades of wire, whether ferrous or non-ferrous, high carbon rope and spring wire, or the common garden variety of nail wire.

✦ ✦ ✦

THE carbide dies have settled quite definitely the old questions and difficulties of "runouts," out-of-roundness, and off-size, and have now become a valuable and dependable tool in the manufacture of quality wire. Since we now have die material to make an accurately sized and shaped wire, our natural inclination has been to speed up the wire drawing blocks or the continuous machines and to get more production, since the dies will "take it."

✦ ✦ ✦

THIS speed-up was accomplished in the low carbon steel grades of wire without sacrifice to quality. Some mills speeded up the old conventional single blocks and others speeded up their continuous wire drawing machines, or both. The addition of water-cooled die boxes controlled to some extent the heat in the die itself, but made little or no difference in the actual frictional or drawing heat of the wire.

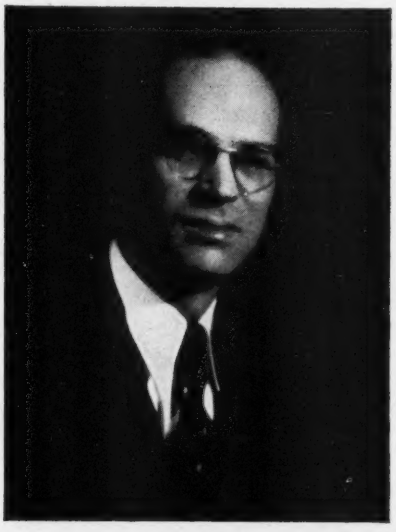
✦ ✦ ✦

HIGH carbon rope wire quality was very definitely improved by the advent of carbide dies since, in the Rope Mill, foot weights, tensile and breaking strengths and rope diameters could all be more accurately controlled with the closer size tolerances on the wire.

But when thought was given to speed-up of rope wire, and particularly the higher tensile grades of Improved Plow and Plow Steel, the torsion specifications and fatigue properties became the limiting factors.

✦ ✦ ✦

ABOUT six (6) or seven (7) years ago, continuous wire drawing machines, equipped with water-cooled blocks, appeared on the market. These machines, of several different makes, had one main important feature in common. That feature was a flow of water directed on the inner surface of relatively thin cast blocks and accomplished the purpose of dissipating or carrying away the frictional or drawing heat of the wire as the strands were drawn around the outside of the block. Whether the machine was a single, heavy bull block type or a light, fast seven (7) or eight (8) hole continuous machine, the wire drawn onto the blocks was cool after a few wraps around the block.



JOHN C. AIKEN

John Connell Aiken was born in Pittsburgh, Penna., on May 18th, 1895. He attended grade and preparatory schools in Pittsburgh and graduated from Washington & Jefferson College in 1916 with a Bachelor of Science Degree. He served in World War I in the U. S. Navy, Mine Laying Squadron aboard the U.S.S. Housatonic and later aboard a troop transport after the Armistice. From 1919 to 1923 he was employed by Oliver Iron & Steel Corporation of Pittsburgh in the bolt and nut business. He became associated with the Jones & Laughlin Steel Corp., Rod & Wire Department in 1923, becoming Rod Mill General Foreman, which position he held until 1935 when he became Asst. Superintendent, Rod & Wire Department. Mr. Aiken is a member of the Wire Association.

✦ ✦ ✦

THIS rapid dissipation of frictional or drawing heat has resulted in a uniformity of tensile and torsional values, plus increases in drawing speeds that were previously unheard of in the manufacture of high tensile rope wire.

✦ ✦ ✦

THERE are literally volumes of old and new practices for drawing rope wire. These practices have many variations. Some patent the rod, then draft part way to the finish size and patent again, even for large and medium sizes. Others take one draft from the green rod, patent air cooled, then draw to intermediate size, repatent lead quench, and finish draw.

✦ ✦ ✦

REDUCTIONS of area have had a wide variance from 15% to 35% in some mills, while in other mills the rule has been one, or one and a quarter gauges per reduction.

✦ ✦ ✦

IN the past, speeds have been essentially slow, due to the heat generated and held in the coils

with the resultant loss in torsions and the lack of uniformity in tensiles. Often, in single draft bench drawing of High Tensile rope wire, a certain amount of cooling time was allowed between each draft.

✦ ✦ ✦

IN the older, single draft method of drawing high tensile rope wire on benches, speeds varied from 100 to 150 F.P.M. on the larger sizes of Improved Plow rope wire probably somewhere in the range of .100″ and larger. As the diameter of the wire decreased, the speeds naturally increased with a probable speed of 225 to 250 F.P.M. in the .060″ to 075″ range, and 350 to 375 F.P.M. in the small, dry drawn sizes.

✦ ✦ ✦

HIGHER speeds were attained in sizes from about .030″ and smaller through the use of wet drawing, in which case the wet lubricant acted as a cooling agent and held down the torsion destroying heat. The modern and present day methods and practices followed in making high tensile rope wire permit speeds of 250 to 300 F.P.M. on sizes of Improved Plow wire in the neighborhood of .125″ or .130″ and naturally as the size decreases the speeds increase so that a speed of about 550 F.P.M. for .078″ wire and 1100 to 1200 F.P.M. for .031″ wire can be attained.

✦ ✦ ✦

THROUGH the use of continuous machines, equipped with water-cooled blocks, a high degree of uniformity in tensile strengths and in torsion twists is attained. This uniformity exists from one end to the other within a given coil of wire, from one coil to another within a given heat and from one heat to another. On the larger wire sizes, torsions of 33 twists in 100 diameters of the wire are consistently met and on intermediate and small sizes, a minimum of 36 torsions is easily met, and averages are considerably higher than this. Tensile tests, as well as the above mentioned torsion tests, are taken from the front, middle and back end of every 300# coil of wire as it is stripped from the finishing block of each wire drawing machine and split to 150# catchweight coils. The test pieces are immediately taken to the physical laboratory, where they are tested for tensile and torsion. In case of failure on either test, the machine is immediately stopped and the cause of the failure checked. Thus, there is no accumulation of rejections, as would be the case if coils were piled on trucks to be tested at a later time in the Bundling Room.

✦ ✦ ✦

AN unusually high degree of uniformity in tensile strength or breaking weight is obtained from end to end of each coil. Even in large sizes, ranging from .090″ to .120″, the variation in breaking weight can be held within 100 to 120 pounds, which, in the sizes and grades involved, means a rather narrow tensile spread.

✦ ✦ ✦

LET us take two (2) sizes of Improved Plow rope wire, one (1) in the larger range of sizes and one (1) in the smaller range; both to be dry drawn throughout and both to be drawn on continuous machines completely equipped with water-cooled blocks. We will follow and briefly describe or tabulate each process from the rolling of the rod in the Rod Mill to the last bundling operation before the wire is loaded for shipment.

✦ ✦ ✦

WE will take, for our large sized wire example, an order for .091″ Bright Improved Plow rope wire with a tensile requirement of 240,000# to 270,000# per square inch, which represents a breaking weight of 1560 to 1740 pounds, and a torsion requirement of 33 minimum twists in 100 diameters of the wire and a gauge tolerance of plus or minus .001″.

✦ ✦ ✦

FOR the small sized wire example, we will take .016″ Bright Improved Plow wire with a tensile requirement of 280,000# to 310,000# per square inch, and a torsion requirement of 36 minimum twists in 100 diameters of the wire and a gauge tolerance of plus or minus .0003″.

✦ ✦ ✦

WE must first determine the size at which we must perform our last patenting, so that we will have the proper amount of cold work in drawing to our finished size to obtain the required tensile strength. A rather simple rule of thumb formula or table is used to determine the answer to this question. We will use an Acid Open Hearth steel for both the large and small wires and will use an analysis of Carbon .67/.72, Manganese .60/.80, Phos. Limit .040, Sulphur Limit .045, and Silicon .10/.25.

✦ ✦ ✦

THE formula or table, used for increase in tensile strength over the patented tensile strength by reduction of area through drafting, is shown in Table A.

✦ ✦ ✦

IN the case of the .091″ Improved Plow wire, we know that our

TABLE A

Per Cent Reduction	Tensile Increase for Each Per Cent Reduction	Total Increase for Total Reduction
1% to 70%	930# per sq. inch	65,000#
70% to 80%	2,000# " " "	85,000
80% to 87%	3,000# " " "	106,000
88%	5,000# " " "	111,000
89%	6,000# " " "	117,000
90%	7,000# " " "	124,000
91%	9,000# " " "	133,000
92%	12,000# " " "	145,000
93%	17,000# " " "	162,000
94%	23,000# " " "	185,000

Changes or variations in the above "rule of thumb" formula can be obtained by as much as 10,000# per square inch tensile by changes in speed of wire drawing. Also by decreasing the number of holes or passes in a given total draft, the tensile strength can be increased as much as 10,000# per square inch.

patented tensile will average about 145,000# per square inch and since we want to meet a finished wire tensile of 240,000# to 270,000# per square inch, we must add about 100,000# to 110,000# tensile through drafting. In looking back at our formula, we see that 86% total draft shows 103,000# increase and since we have found that Acid Open Hearth steel gives us results on the high side of the formula, we will try an 86% draft. Working backwards from .091" for an 86% draft, we find that we should start with a patented size of .244" wire.

✦ ✦ ✦

LIKEWISE, on the .016" Improved Plow wire, we figure a patented tensile of about 160,000# per square inch, which we obtain from an electric resistance patenting frame and, since we want to meet a finished tensile of 280,000# to 310,000# per square inch, or a mean figure of 290,000#, we must add about 120,000# to 130,000# tensile through drafting. Again referring to the formula and with some allowances for severe reductions of area, we determine that we should have about a 90% total reduction of area. Again, the slide rule tells us that we should start with a patented size of .051" wire.

✦ ✦ ✦

HAVING now determined the steel grade and analysis that we will use and having calculated the amount of final drafting needed after the last patenting operation, our job of producing these two orders lines up as shown in Table B.

Rod Mill

THE rods for each of the two (2) orders are rolled to size on continuous rod mills to 300# coils and are thoroughly inspected, coil by coil, on the conveyor at the Rod Mill by the Inspection Department. This inspection covers size, shape, fins, visible pipes or laps, slivers or any other defects that can be readily seen. A test piece from each end of each rod coil is cut off and duplicate numbered tags are attached to the test pieces and to the coil. The rods are then placed in stock in the Rod Mill and the test pieces sent to the physical laboratory for etch test examination. Each sample is deep etched in hydrochloric acid and then examined for seaminess, segregation or surface defects. After the examination of the etch tests, any defective rods are culled out and the remaining coils are then ready to start through the mill.

✦ ✦ ✦

AT this point, we will first follow through the Wire Mill the rods for the .091" Improved Plow order, since there are comparatively few operations involved in producing this size; and then we will go back after we have finished the .091" and follow through with the .016" size. ✦ ✦ ✦

THE 17/64 rods for the .091" Improved Plow order are hauled into the Cleaning House, where they are cleaned in the sulphuric pickle tubs, concentration of 7 or 8% of 66° Baume Sulphuric Acid at a temperature of 110° to 120° F., and with a good inhibitor to prevent overpickling. They are then lime coated and baked and drawn one hole to .244" wire.

THIS .244" wire is then delivered to the patenting furnace, which is a conventional fuel fired type of furnace, where the wire is patent annealed at high temperature and cooled in the air. Frequent observations of furnace temperatures are made by the furnace operator, and frequent readings of the wire temperatures at the exit end of the furnace are made by the use of optical pyrometers in the hands of Metallurgical Department inspectors. From each "round" or lot run on the patenting furnace, tests are cut and are pulled for tensile and percent reduction at the tensile break.

✦ ✦ ✦

AFTER patenting, the .244" wire is again cleaned or pickled, lime coated by dipping in heavy lime and thoroughly baked. The cleaned, lime coated and baked wire is then taken to the continuous wire drawing machine and drawn 6 drafts to .091", a total reduction in area of 86%, and at a speed of about 400 F.P.M. on a 22" finishing block. The machines are equipped with double "flippers" or pay-offs and the last end of one coil is welded to the first end of a new coil. This welded portion is marked by wiping or coating it with a copper sulphate solution, so that, as the finished bright wire is drawn onto the finishing block, the position of the copper colored weld is readily seen. The machine is stopped, the wire drawer cuts out the welded portion, splits the 300# coil in half, cuts test pieces from the front, middle and back end of the 300# coil and then starts his machine again. These test pieces are immediately picked up by the Metallurgical Department inspector and are twisted for torsion, pulled for tensile, examined for cuppy breaks which might indicate segregation, gauged for size, and if all requirements are met and the wire is acceptable, each coil is tagged to show size, torsion of each end of the coil, and breaking weight of each end. The wire is then bundled carefully, coated with rust preventive oil, and is ready for shipment.

(*Please turn to Page 668*)

TABLE B

.091" Improved Plow Wire	.016" Improved Plow Wire
Rod Size—17/64 Rod (.265)	Rod Size—#5 Rod (.218")
Draw Green—To .244" Wire	1st Patenting—Air Cool #5 Rod
1st Patenting—Air Cool—.244 Wire	1st Drawing—#5 Rod A.C. Patented to .124"—68% reduction of area.
1st Draw after Patenting—6 Holes to .091" 86% Red. of Area.	2nd Patenting—.124" A.C. Patented.
Total Reduction from the Rod—89%	2nd Drawing—.124" A.C. Patented to .051"—83% reduction of area.
	3rd Patenting—.051" Electric Resistance Patented.
	3rd Drawing—8 holes to .016"—90% Reduction of Area.
	Total Reduction from the Rod — 99.44%

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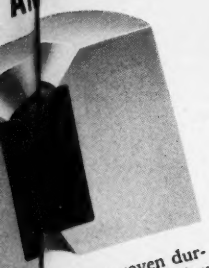

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WIRE DRAWING

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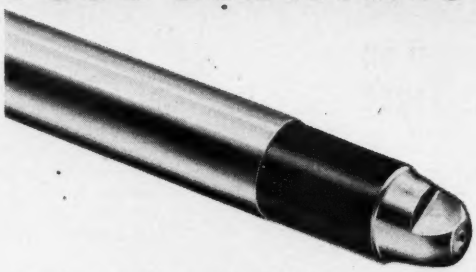
TUBE DRAWING



Turning out the many diversified types of tubing—including steel, aluminum, bronze, cupro-nickel and other alloy tubing vital to war—has been a job in which the extra performance of Carboloy Cemented Carbides has proven to be of immeasurable value.

The extra long life, unusual strength and mirror like finish of Carboloy "Grade 958" Carboloy Mandrels—plus the uniform, dependable performance of Carboloy Tube Drawing Dies, has resulted in an extremely high improved order of performance on this vital war work.

WIRE FORMING

Among the numerous miscellaneous uses of Carboloy Cemented Carbides in the wire industry are the application of guides, arbors, pitch tools, coiling points, etc., for spring forming and other wire fabrication. Carboloy parts on such work provide up to 50 times longer life—provide more continuous operation—improve quality of wire products.

SHEET METAL DRAWING AND FORMING

In cartridge case manufacture (today's most important use of carbides for sheet metal work), not only have Carboloy Dies speeded up production with high standards of finish and close tolerances but they have also made possible the conversion from brass to steel in many sizes—saving tons of critical metal. For example, on one contract alone, for 105-mm shell—according to U.S. Army Ordnance—12,600 tons of brass were saved through conversion to steel cases.

Recent completion at the Carboloy plant of the 50,000th cartridge case die—each capable of producing one million to twenty million cartridge cases—indicates the widespread use of carbide dies for this vital work.

SHEET METAL DIES UP TO 20" O.D.

Carboloy Die research and development continues on during the war. One result has been steady increase in die sizes practical for carbides. Today, sizes that, in many cases were impossible to produce a year or two ago are now part of regular production. Carboloy Die Nibs up to 20" O.D. are today available—for war and postwar.

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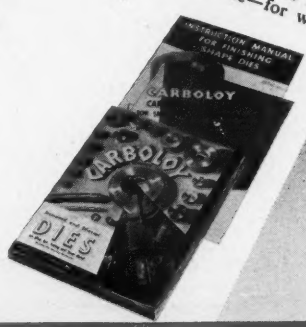

TECHNICAL LITERATURE

Comprehensive engineering bulletins, instruction booklets, etc., available without charge to assist in training of men handling carbide dies.

LOY CEMENTED CARBIDE

THE DEMAND

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Hartley Wire Die Co., Thomaston, Conn.
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Canadian General Electric Company, Ltd., Toronto
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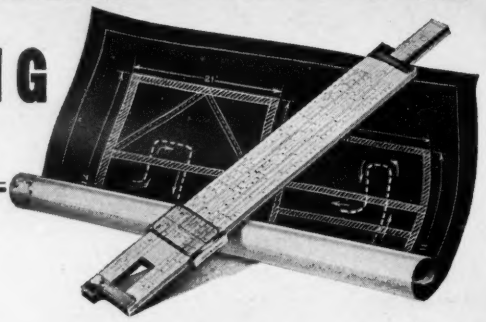
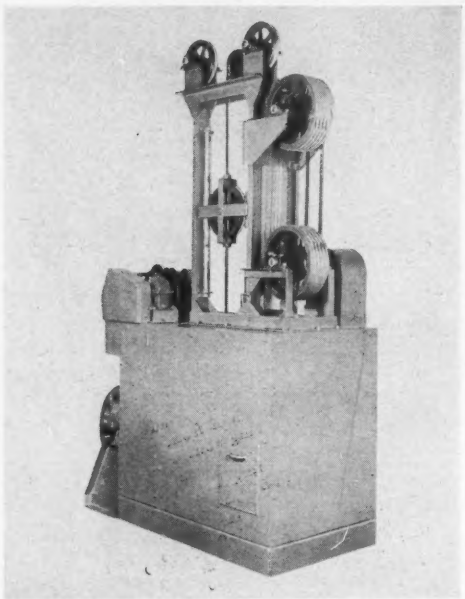
OVEN ENGINEERING NEWS



New Wind-up Machine Achieves Constant Speed and Tension on Wire, Cable, Textiles, Tapes



One year ago, when the Industrial Oven Engineering Company designed its first cable lacquering tower, industry was given a new conception of speed and efficiency in the impregnation and coating of insulated wire and cable.

At the same time, to meet strict Army-Navy specifications for uniform and concentric finishes, Industrial Oven designed and built a new type constant-speed, constant-tension wind-up machine, superseding the makeshift devices which had previously actuated cable lacquer systems. This machine, shown above, is now made in two standard sizes, and can be adapted for the wind-up of cords, rope, cable, paper, tapes of various kinds, textiles and coated fabrics.

(Note: One unit is available in our plant for experimental runs of customers' materials. Contact us for appointment.)

Wide Tension Range

This wind-up machine is a complete, self-contained unit with combination variable speed and hydraulic synchronizing equipment, designed to provide constant speed and constant tension within a variable production range. By arrangement of adjustable counterweights, wire tension can be varied from a few ounces to hundreds of pounds. It comprises a dismountable reel stand, multi-wrap large-diameter capstans, constant but variable tension mechanism and an adjustable level winder, and is also equipped with provisions for driving assisting capstans which are required on some grades of fine wire being processed through multi-coat finishes. It is motor driven and requires no outside source of power or synchronization.

For Extrusion Windup

It is available in higher operating speeds for extrusion wind-up in the use of rubber or synthetic insulation materials, and continuous wind-up machines of the same basic design with high-speed crossover are available.

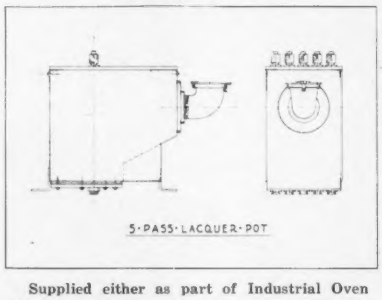
Standard sizes:

No. 1—24" to 36" diameter reel sizes.

No. 2—14" to 22" diameter reel sizes.

Similarly efficient unwind stands are also supplied in standard sizes for semi-automatic operation. The operator simply rolls the reel into position and steps on a foot pedal to raise the reel and set a counter-weighted tension brake simultaneously.

Lacquer Pots



Supplied either as part of Industrial Oven lacquer systems or for independent use, the lacquer pots shown here are designed for single or multi-pass lacquering, and are furnished in single-pass, standard for saturation, and 5- and 6-pass, standard for lacquering. Other units can be furnished for any number of passes.

Use of these pots will assure 100 per cent coverage of braid, and positive wiping to reduce excessive lacquer coating. Lacquer frothing and blushing of finishes are considerably reduced by proper control of lacquer eddy currents and lacquer disengagement prior to wiping.

These component parts—wind-up machine, unwind stand, and lacquer pots—function as one unit when used with an Industrial Oven Engineering Company high-speed lacquer tower. Together they form the correct combination of functionally engineered equipment for lacquering, varnishing, or otherwise impregnating insulated wire and cable, as well as a large number of other materials handled in continuous lengths.

Regular Installations of the Industrial Oven Engineering Co.

1. **Synthetic tire fabric dipping and drying equipment.**
2. **Synthetic tire fabric post-calendar dipping systems.**
3. **Insulated wire and cable lacquering equipment.**
4. **Coated fabric impregnation systems.**
5. **Rubber curing ovens.**

Free Engineering Book

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(Feel free to ask for additional information on any fact presented on this page.)

THE INDUSTRIAL *Oven Engineering* COMPANY

11621 Detroit Avenue **Cleveland, Ohio**

Hydrogen Brittleness in Spring Steels

By Rodman R. Tatnall,
Metallurgical Engineer, Morgan Works,
Wickwire Spencer Steel Co., Worcester, Mass.

'Acid brittleness' is no stranger to the wire maker. Wire cannot be drawn if proper steps to prevent or to counter-act this phenomenon are not taken in the manufacturing process. In wire making, these steps are well established by experience and science, and this brittleness is now more of a nuisance than a setback. Present day pressure for high quality and high production, and special uses of various wires is bringing out the fact that there are many conditions under which a similar brittleness may develop. To help in solving these problems is the purpose of this discussion. ✦ ✦

Occurrence

HYDROGEN embrittlement may arise in a number of ways, or rather, may have its origin in a number of different conditions. The older term 'acid brittleness' arose from the fact that pickling in acid is the most common and probably the first cause to be recognized. In addition to this, however, there are many factors in the use of wire in various manufacturing steps which may cause the same condition, and the trouble can be traced back to the same fundamental origin. The basic cause of brittleness in this instance is the absorption of hydrogen in the crystal structure of the metal. It seems that nascent, or atomic, hydrogen is quite readily absorbed by steel. There is considerable doubt as to the exact mechanism of this absorption but the majority of opinion favors the theory that there is some kind of solution in the grain boundary material of the metal.

✦ ✦ ✦

THE action of acid on metal releases atoms of hydrogen gas. With the commonly used acids, these atoms may enter the steel while in the atomic state, or they may combine together to form molecules, which is the normal and stable form of the gas. Molecular hydrogen apparently is not soluble in the metal. It is interesting to note in passing that pickling in nitric acid does not cause brittleness. The explanation of this lies in the fact that, chemically, nitric is an oxidizing acid. At the same time that it acts on the metal, the hydrogen produced breaks down some acid molecules because of its strong affinity for oxygen, and thus forms water before it can damage the metal.

RODMAN R. TATNALL

Born in New Rochelle, N. Y. in 1906. Educated at Worcester Polytechnic Institute. Employed one year in Mechanical Development Dept. of the Waltham Watch Co. Joined Wickwire Spencer Steel Co. as engineer in the spring production department in 1928. Two years later took over the work of metallurgical engineer, covering design and application of springs and spring wires, and research and experiment in the development and properties of these materials. Past four years in charge of physical testing laboratory. Member of Wire Association, chairman of Worcester Regional meetings, and member of American Society for Metals.

IN addition to acid pickling, which liberates hydrogen in chemical action, one of the chief potential sources of trouble is electro-plating from cyanide solutions. In this case, the electro-chemical action readily liberates hydrogen from the cyanide at the cathode, which is the piece being plated. This release of hydrogen will be especially vigorous at high current densities, which are often required to plate uniformly parts of a complicated shape. Also there is the factor of cleaning the parts preparatory to the plating operation. Galvanizing, tinning, Parkerizing, and other protective coatings present the same problem because they usually involve a cleaning and fluxing of the surface. It is generally necessary to use acid, or acid-forming elements, and if the coating is thick and non-porous, the very cause of the brittleness may be trapped within the steel. Corrosion, or rusting, may bring some embrittlement with it because of the conditions causing the appearance of rust. The flux used in soldering or brazing operations may be the cause. Any of these things may set up some degree of brittleness of this type, which may or may not be serious, depending on the nature of the handling, and the requirements placed on the part after treatment.

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THE occurrence of embrittlement is manifested in several ways. It is reflected in the physical properties of the wire and its effect is all too apparent in the processing or use of wire. Tensile strength is lowered, as are ductility measurements such as elongation and reduction of area. Ability to stand

cold working or cold bending is markedly lessened. In wire drawing, ductility is not sufficient to withstand drafting. In cold rolling strip, checks and cracks will occur along the edges of the strip. Difficulty is encountered in successfully forming, swedging, heading, or indeed, in any cold working operation. In addition to this, a peculiar type of fracture sometimes occurs after some definite but not very long time under a load as little as 1/10 of the ultimate strength of the material. An outstanding example of this is the now famous Mt. Hope bridge wire, which was processed in a continuous line consisting of oil tempering, acid cleaning, and galvanizing. When formed into loops at the anchorage of the bridge and laid into the cables, breaks were found after one to two days. The only logical explanation of these breaks, when all the facts are studied, is the brittleness set up at the time of manufacture and trapped under the zinc coating. together with the conditions of loading placed on the wire loops. Similar failures under light loads have been found in a variety of spring parts plated or otherwise treated and immediately assembled, such breaks occuring 12 to 36 hours after assembly. The fractures in all these cases show no ductility, and the fractured surfaces have the appearance of burnt or over-heated steel, coarsely crystalline.

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THE wire man knows that the embrittling effect of the pickling operation is very different in low carbon steel from the effect under the same conditions in high carbon steels. A difference will also be found with the same steel in different structural conditions — for example, spring steel hard drawn, and the same steel hardened and tempered. Again, there is a difference in the embrittling effect depending on the conditions surrounding its cause. In the case of acid pickling, for instance, type of acid, strength, temperature, and time are all factors in the final damage done to the steel.

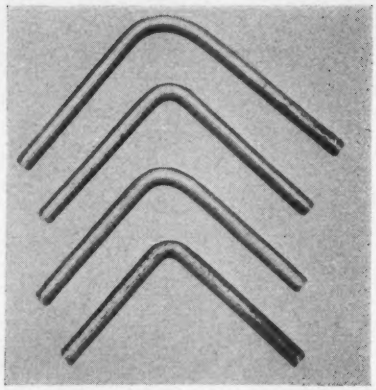

Fig. 1. Illustrating the relative sharpness of bends on arbors 1, 2, 3, and 4 times the diameter of wire.

✦ ✦ ✦ ✦

Measurement

IN measuring the effect under discussion, it is necessary to select some one of the physical properties as an index. Two Russian workers, Chufarov and Nosgireva[1] have reported on a deep drawing steel analysing .15% carbon, .40% manganese, using elongation in the tensile test as the chief indicator of the effect. They conclude that tensile strength of this steel in not seriously affected, while elongation is decreased 20 to 25%. The writer has used a single bend around an arbor of known relation to the wire size as a measure of ability to deform. It is probable that all tests indicating ductility follow a similar pattern, although some may be more sensitive than others. Table I is a summary of various test results for different properties before and after pickling, giving an indication of the magnitude of effect on each. Figure 1 shows a sample of wire bent on arbors 1, 2, 3, and 4 times the size of the wire, indicating the relative sharpness of deformation involved.

[1]'Hydrogen Brittleness of Steel', Stal, Vol. 1, No. 5, 1941.

✦ ✦ ✦

Present Investigation

IN the present work, it was decided to rely on the bend test as being sufficiently sensitive and giving the most practical results. Accordingly, arbors of various sizes from 1 to 4-½ times the wire size by steps of ¼ were provided for a bending jig. The wire chosen was #12 (.1055) for all tests. With this type of test, a direct index of brittleness was obtained, since any good spring wire in this size should bend around its own diameter as an arbor without fracture. Therefore, fracture on this or any larger arbor not only indicated damage, but gave a measure of the amount of damage in terms of the arbor relation to the wire size.

✦ ✦ ✦

THE types and conditions of wires shown in Table I were used in this work. Samples were taken from commercial runs of wire, and represent common spring materials. Sulphuric acid, 8% at 140° F., and 50% hydrochloric acid both at room temperature and at 170° F. were used for pickling. While sufficient data were not developed for a comparison of the action of the two kinds of acid, indications are that the effect of each is very little, if any, different under the conditions they were used in the experiments. Only the two concentrations and limited temperatures were used, since time

TABLE I
COMPARATIVE PHYSICAL PROPERTIES
Before and After Pickling

Type of Steel	Condition	Tensile	Red. Of Area	Bend
SAE 1065 Hard Drawn	Before	198,000	58%	1
SAE 1065 Hard Drawn	After	167,000	50%	1
SAE 1065 Oil Tempered	Before	240,000	53%	1
SAE 1065 Oil Tempered	After	187,000	Low[1]	3
SAE 6150 Oil Tempered	Before	218,000	57%	1
SAE 6150 Oil Tempered	After	184,000	Low[1]	2
SAE 1095 Hard Drawn	Before	284,000	45%	1
SAE 1095 Hard Drawn	After	235,000	47%	1¼

[1] Note — No appreciable reduction was found.

has not allowed exploration of these factors as much as might be desired.

✦ ✦ ✦

TABLE I gives an indication of the different susceptibilities of the various wires to embrittlement, and Table II ties this in with the recognized difference in solution rate of the materials, which has been brought out by pickling samples simultaneously in the same acid for the same length of time. There are many factors underlying the simple figures given in these tables. Significant in the results is the difference between the hard drawn and heat treated 1065 steel. The difference between the two hard drawn steels in Table I, 1065 and 1095, may be due in part to analysis and in part to the greater amount of cold work and the different process treatment given to the sample of 1095 steel used. A comparison of these two steels cannot have any great significance without a deeper study of underlying factors, since the trend shown in Table I does not agree with that presented in Table II.

✦ ✦ ✦

ADDITIONAL factors in the problem under discussion are the time of pickling and the temperature of the pickle bath. Figures 2 and 3 show the plotting of test data which illustrates these two phases together with additional data on the different kinds of wire. First, the two sets of curves offer a comparison of treatment at room temperature and at 170° F. From this comparison, it seems that the greatest amount of damage occurs at room temperature, in spite of a more vigorous chemical action at the higher temperature. This may be explained, perhaps, by the fact that at the higher temperature there is a greater tendency for the hydrogen produced to combine into molecules and escape.

✦ ✦ ✦

IN these curves also is brought out the marked difference in the effect on cold drawn and heat treated wires. Figure 3 shows an

TABLE II
ACID ACTION ON VARIOUS STEELS
Hydrochloric Acid 170° F.

Type of Steel	Dia. Before	Dia. After	Loss in Dia.	Time Immersed
SAE 1065 Hard Drawn	.1066	.1060	.0006	30 min.
SAE 1065 Oil Tempered	.1054	.1038	.0016	30 min.
SAE 6150 Oil Tempered	.1062	.1041	.0021	30 min.
SAE 1095 Hard Drawn	.1066 6	.1047	.0019	30 min.

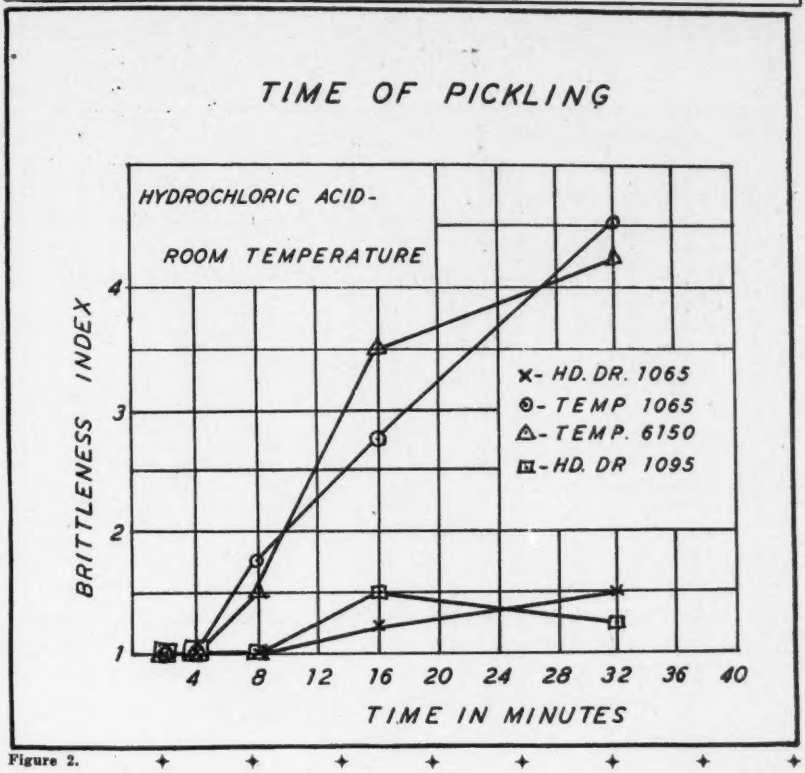

Figure 2.

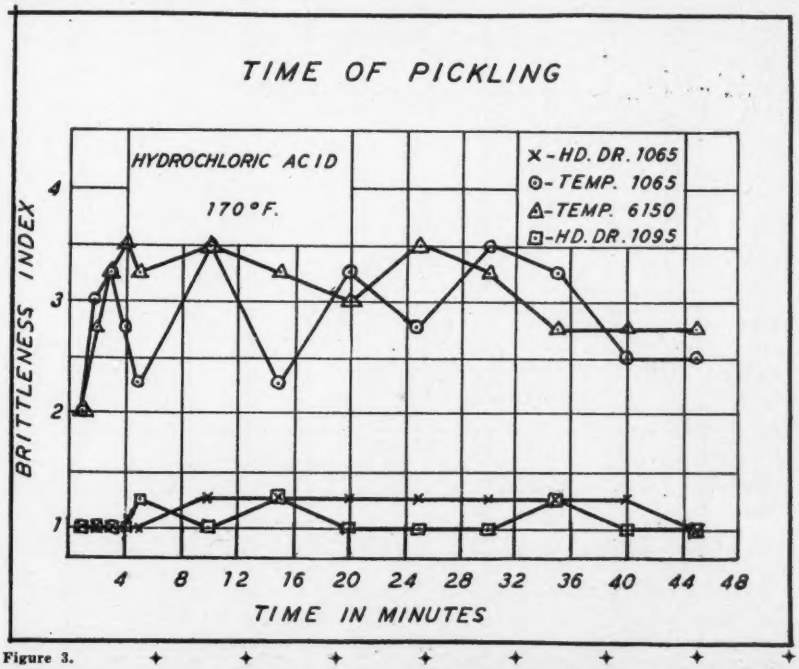

Figure 3.

index of brittleness for the heat treated wires consistently at least two points higher than that of the cold worked wires. In Figure 2 the difference is even more, being, apparently, a function of the time of pickling. In addition to this, the damage to the cold drawn wires does not occur until an appreciable time later than the heat treated wires.

✦ ✦ ✦

THE foregoing indications may be considered as indirect evidence supporting the theory of intergranular attack by the hydrogen. The heat treated wire has a clear cut granular structure, whereas the cold worked wire has a structure severely deformed, with no distinct grain boundaries left in existence.

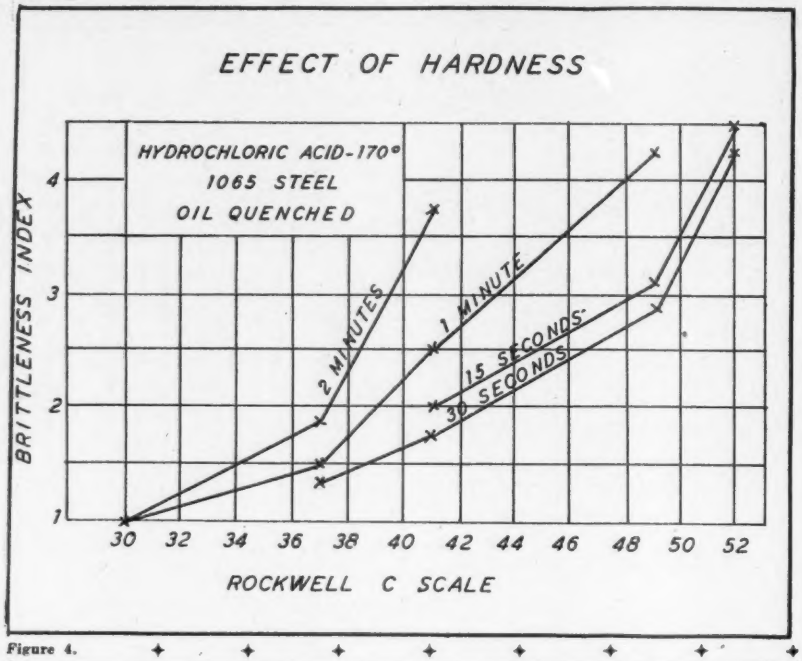

Figure 4.

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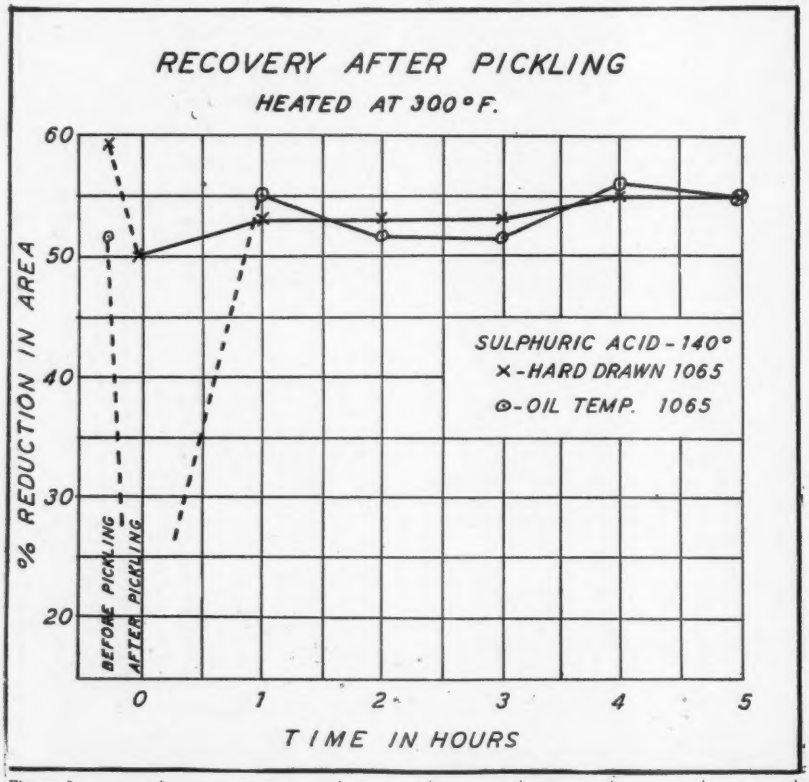

Figure 5.

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✦ ✦ ✦

TIME of pickling shows some interesting phenomena. At room temperature (Fig. 2) in the case of the tempered wires, there seems to be no damage for an appreciable time. Thereafter, the damage increases steadily with time. On the cold drawn wires, the damage occurs later, is much less serious, and tends to remain constant with increased time. In this case, hydrochloric acid pickling was used, and the first chemical action is an attack on the scale on the surface of the wire. After this is removed, in the case of the heat treated wires, the attack on the metal sets up the damage. With the cold drawn wires, there is no scale, but there is a surface film which is quickly soluble in the acid. Damage from the action on the metal occurs later and is less serious probably because of the much smaller quantity of hydrogen that the cold worked structure is capable of absorbing.

✦ ✦ ✦

AT 170° F. damage occurs rapidly in the case of the tempered wires, a little less rapidly on the cold worked wires. However, the amount of damage that is imparted in this case holds fairly constant for prolonged times. This behaviour is in all probability the result of an equilibrium between the quantity of hydrogen generated, the rate at which the steel can absorb it, and the rate at which atoms combine into the molecular form and escape. This rate of combination is undoubtedly greater in proportion to the temperature increase than the increment in generation due to the same temperature increase.

✦ ✦ ✦

TWO important and related facts stand out in this data on time and temperature of hydrochloric acid pickling. First, a short dip, up

to 3 or 4 minutes, at room temperature will not cause any appreciable damage. while the same dip at higher temperature will cause marked damage. Secondly, overpickling, in point of time, at room temperature, will cause increasing damage as the time is prolonged. This is borne out by operating practice in cleaning parts for plating, in which first cleaning may be done by tumbling or sand blasting, followed by an acid dip and washes in suitable solutions to produce a truly clean surface. The conclusion to be drawn is that a short time in weak hydrochloric acid at room temperature can be carried out without appreciable damage to the material.

✦ ✦ ✦

AN interesting phase of the problem in connection with tempered wire relates to time of pickling and involves the hardness of the heat treated wire. In Figure 4 are shown the results of tests on wires varying from 52 Rockwell C to 30 Rockwell C, and pickled for times varying from 15 seconds to 2 minutes. These curves show that time plays an important part, but even more important is the greater susceptibility to damage of the wire with the higher Rockwell hardness. One and even two minutes pickling has not damaged the 30 Rockwell wire, whereas 15 seconds is long enough to seriously damage the 49 and 52 Rockwell material. Before pickling, the 52 Rockwell sample showed a brittleness index of 2-¼, as might be expected from the hardness imparted. The 49 Rockwell sample showed an index of 1-¼ as heat treated, and all the other samples showed index 1. An adjustment has therefore been made in plotting Figure 4 to allow for the lack of ductility in the two hardest samples, in order that the graph may show the true damage due to pickling effect.

✦ ✦ ✦

Recovery of Ductility

THAT a recovery from the effects of hydrogen embrittlement is possible is amply demonstrated by the use of bakers in the wire industry. However, some data on this topic may be of interest. The Russian workers cited previously show that 1 hour at temperatures from 100°C. to 200°C. (212°F. to 390°F.) is sufficient to restore the original properties in the .15 carbon steel they used.

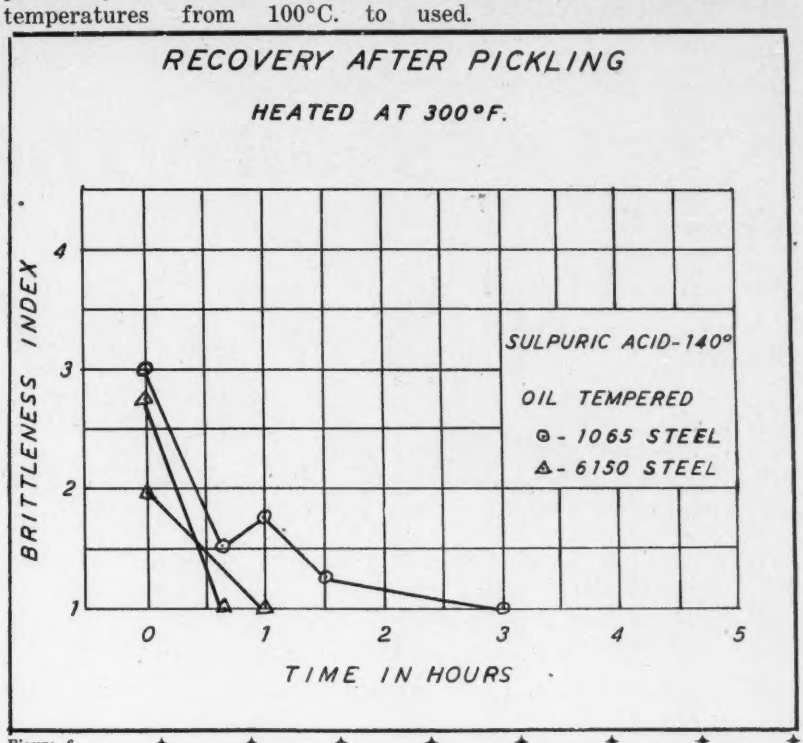


Figure 6.

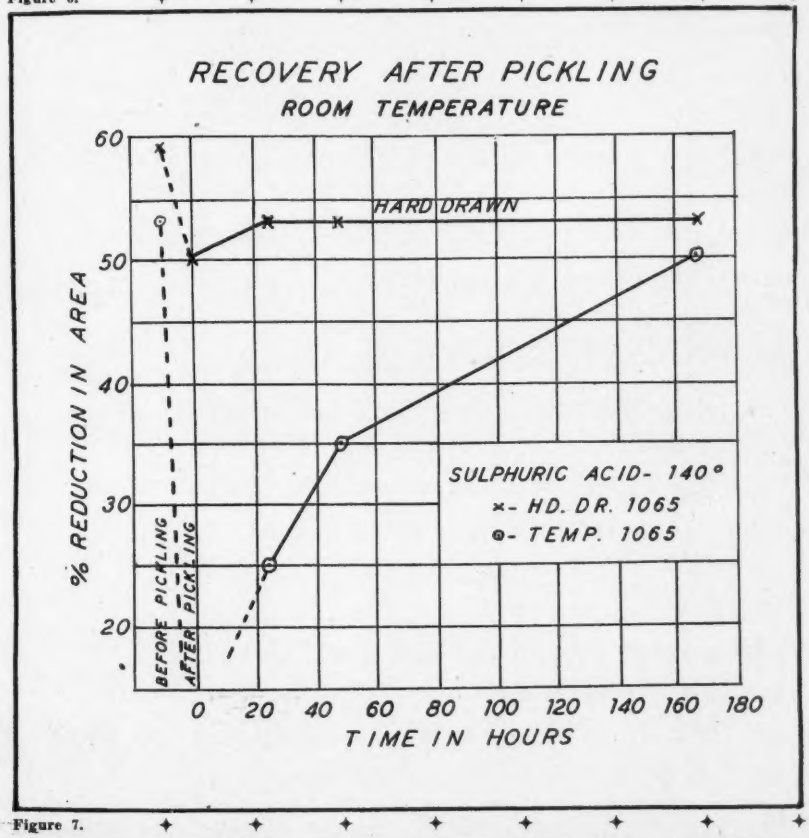


Figure 7.

A FIRM OF BRITISH MANUFACTURERS

"LET'S GET TOGETHER"

NOW!

Now that our Premier and your President have got together with such good results, isn't it possible that business and industry might follow their example?

People in your country and ours are using what little spare time they have to make plans for peace. And everything points to the necessity of British and American industry being in future colleagues and associates, instead of friendly rivals, working together in peace as in war for their mutual advantage.

We at Marshalls have thought this over, and we say "Why wait—let's get together *now*." Even in the midst of our maximum war effort let's start pooling our ideas now, so that when peace comes the overture will have been played and we shall both be ready to step off together.

We are a large and progressive firm of engineers with a century of experience behind us. A special branch of our organisation is devoted to the design and manufacture of wire drawing machinery and ancillary plant. We have done some good work in this field, but we do not rest on our laurels—we are always seeking ways of improving ourselves and our products.

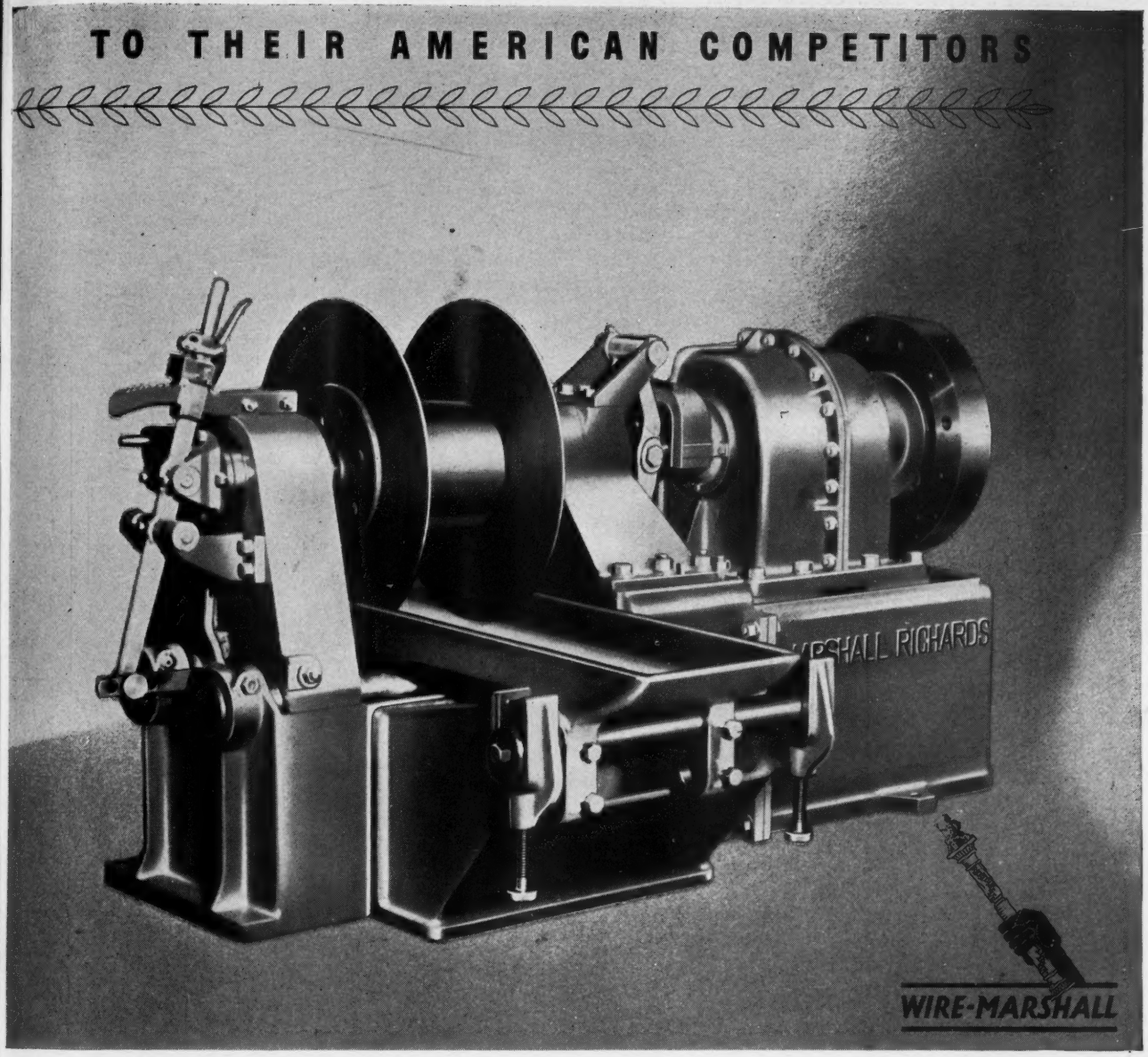
On the opposite page you will see one result of this policy—Marshalls' latest High Speed Spooling Machine. We know this machine is unique in its line. But we know too that you have produced machines that are equally advanced in other ways. Let's swop our ideas. Let's plan a long-term post-war policy together.

If you are interested, write to Marshall Richards Machine Co. Ltd., Gainsborough, England. (The Wire Drawing Machinery Division of Marshalls of Gainsborough.)

MARSHALLS

OF GAINSBOROUGH

TO THEIR AMERICAN COMPETITORS



TYPICAL "MARSHALL RICHARDS" HIGH SPEED SPOOLING MACHINE

Suitable for spooling Wire in sizes from 6 to 20 B. & S. Gauge, on reels carrying from 100 to 1,000 lbs. winding at speeds up to 4,500 feet per minute.

- **NO BELTS running on the wire or gadgets operated by the wire.**
- **SPEED VARIATION—completely automatic over full range of reel sizes.**
- **WINDING TENSION—to suit requirements, for hard drawing or for annealing on spools.**
- **NO OVER-RUNNING at Starting or at Stopping.**
- **DRIVEN DIRECTLY from the Wire Drawing Machine.**

FIGURES 5 thru 8 show the results of tests on samples given recovery treatments after pickling. Again it is necessary to consider time and temperature in their co-relation, and an interesting comparison of properties can be made. Figure 5 is a graph of Reduction in Area and time of treatment at 300°F. in a still air oven, while Figure 6 plots the brittleness index of the same samples with the same time values. It is to be noted that complete recovery of Reduction in Area value in the 1065 oil tempered steel is obtained in 1 hour, whereas complete recovery of bending ability is not found until the treatment has continued for 3 hours. At room temperature Figures 7 and 8, recovery in both properties seems to be obtained in about the same length of time.

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REDUCTION in area values are a good measure of ductility for most purposes. Comparison of the two sets of curves shows that the bending test is more sensitive to the condition here discussed.

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IT should be remembered that with some types of brittleness it is not possible to utilize the comparatively rapid and sure recovery afforded by high temperature 'baking.' For example, relief of brittleness from plating can only be obtained by treatment at a temperature which is limited by the possibility of damage to the plated coating. In some cases, this limit may be as low as 150°F, and seldom can exceed 300°F. It is common practice to heat cadmium and chromium plated springs to 300°F. after plating as a safeguard. In other cases, notably zinc plating, heating cannot be done, and extra care must be exercised to prevent damage in the cleaning and plating operations, since no corrective treatment can be employed later.

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NOTE should be taken of the time comparison afforded by these curves — 3 hours at 300°F. against 168 hours at room temperature.

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IT was found that there was a marked drop in tensile strength of these steels after pickling, as shown by the figures in Table I. This loss in tensile strength is only partially recovered even at the point where bending ability has been fully restored.

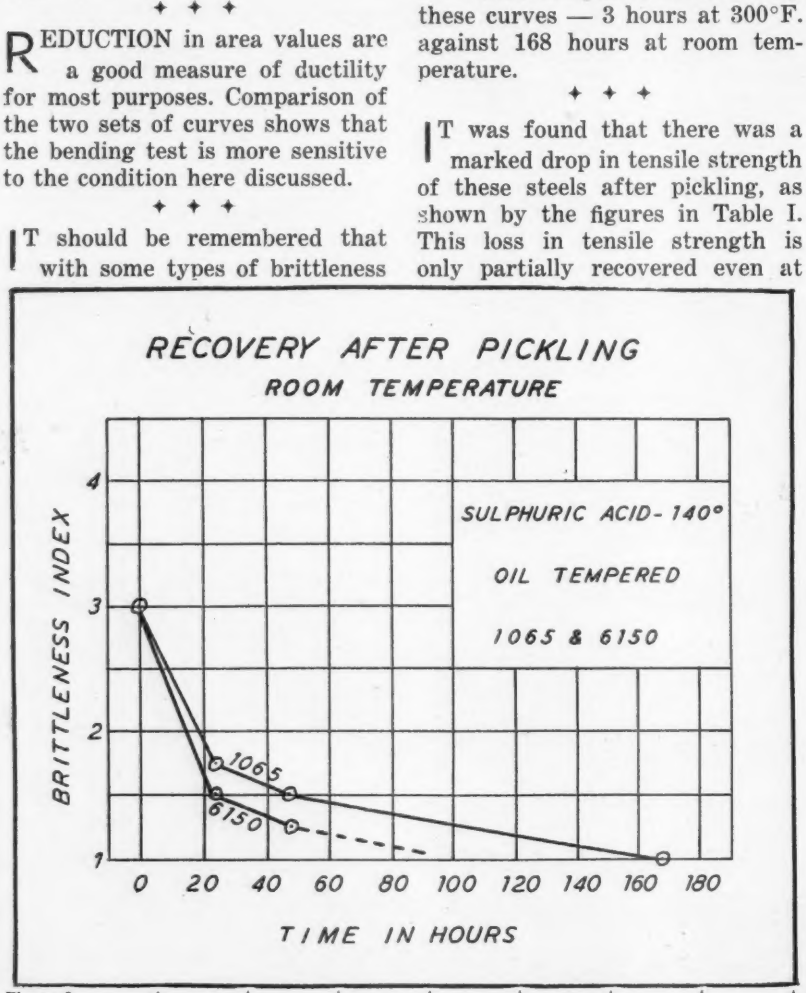

Figure 8.

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Conclusion

THE danger of brittleness is always present in the treatment of steel by processes that produce hydrogen, although careful control minimizes its occurrence. The application of a remedial treatment is a step that is recognized, and indeed, demanded, for material to meet exacting requirements. This is particularly true of springs and other parts which must be given a rust-proof finish and which must meet high fatigue specifications.

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SINCE the wire maker is likely to encounter this problem sooner or later outside his own manufacturing processes, it is hoped that this discussion, illustrated by the data offered, will serve to clarify the technicalities involved.

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IN summary, the following points should be emphasized.

1. **Hardened and tempered wire or parts are much more susceptible than cold worked wire to hydrogen embrittlement.**
2. **In hardened and tempered wire, the higher the Rockwell value the more susceptible is the material.**
3. **Recovery from brittleness takes place at room temperature slowly, full recovery requiring a considerable number of days.**
4. **This recovery may be greatly accelerated by the application of heat.**

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IN order to fully evaluate the effects noted in this discussion, further investigation of such factors as acid strength, inhibitors in the acid bath, and an extension of the temperature range in recovery treatments, is highly desirable.

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AN apt quotation comes to mind which applies not only to the brittleness encountered by the wire maker, but equally well to the many other situations in which the same trouble may arise —

"Acid is the poison of the wire industry, and an over-dose must be followed by an antidote."

The Properties and Uses of Vinyl Resins for Wire and Cable

By George A. Fowles,
Engineer, Plastic Materials Division,
B. F. Goodrich Company, Akron, Ohio.

A. Introduction

After fifty years of the continuous use of natural rubber for insulating and jacketing wire and cable this industry in the last five years has been converted almost completely to the use of synthetic rubbers and thermoplastics. Of the thermoplastics the vinyl resins have occupied the spotlight. The ease of extrusion and the elimination of the vulcanization process have greatly expedited their use. Also elimination of the milling process by the use of plastic extruders has saved machinery, manpower, and time, and has enabled the insulated wire manufacturers to keep up with the tremendous electrical needs of this modern war of the electronic physicists and electrical engineers.

I. Properties

OF THE many commercial vinyl resins available for use the best known are the **polymers** of:

Vinyl acetate
Vinyl alcohol
Vinyl butyral
Vinyl chloride
Vinyl formal
Vinylidene chloride

And the co-polymers of:

Vinyl acetate and vinyl chloride
Vinyl chloride and vinylidene chloride

✦ ✦ ✦

THE most widely used of these vinyl resins for the wire and cable industry have been the polymers and co-polymers of vinyl chloride. For the last three or four years the Navy in particular and lately the other armed services have used very large quantities of the vinyl chloride and vinyl chloride — vinyl acetate polymers for insulation and protective jackets on wire and cable.

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THE property of these latter polymers which makes them desirable for use on wire and cable is their ability to combine with plasticizers to form elastic materials which are dimensionably stable over reasonable operating temperatures, which may be readily extruded at temperatures of 300 to 400° F. and which have most of the other properties desired for insulated wire. The many types of plasticizers that may be used and the variable properties of the plasticizers make it possible to formulate compounds to meet the varying needs of the wire designer and user.

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THESE plasticized polymers may contain from 10 to 40% plasticizer depending upon the hardness or softness of the material desired. Special properties may be obtained by adding pigments such as carbon black, whiting, clay and other. In almost all of the formulations used, a stabilizer is added to prevent or retard the chemical breakdown of the polymer and to improve the electrical properties of the resultant compound.

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AT THE present, most of these plasticized vinyl resins are supplied in the form of tape, batch sheet, or granules, which are fed into extruders and thus formed as a covering on the wire. They may be supplied also in the form of tape to be wrapped directly on the wire. Such tape insulated wires may be later heated to obtain a completely sealed covering. They are usually covered with other forms of outer protection, such as cotton, glass, or metal braids.

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B. Physical Properties

AS USED by the wire and cable industry the extruded or taped plasticized vinyl resins applied to the wire usually have physical properties within the following range: (See Table I).

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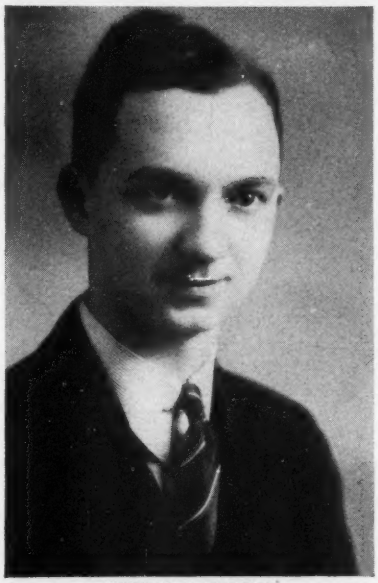
NO ONE compound as yet has all the desirable properties listed in the above table, but as with rubber compounding and any other chemical formulations these plastic compounds for wire use are compromises designed to cover the range needed for a particular application or group of applications. Because of the fairly thin walls used on single insulated conductors and because in most cases the individual conductors of a cable



GEORGE A. FOWLES

George A. Fowles graduated from Massachusetts Institute of Technology with a B.S. in electrical engineering. Started work with Anaconda Wire and Cable Company in Pawtucket, R. I., as assistant to chief engineer. Leaving Anaconda he served as engineer with Jackson & Moreland, Consulting Engineers, in appraisals and engineering studies for various utility systems such as New England Power Association, Philadelphia Electric Company, Pennsylvania Power & Light Company, Suburban Gas and Electric Company. In 1941 became associated with the Plastic Materials Div. of B. F. Goodrich Co., Akron, Ohio, as an engineer. He is an associate member of the American Institute of Electrical Engineers.

TABLE I
Physical Properties of Extruded or Taped Plasticized Vinyl Resins

Tensile strength	**1500 to 3000 lbs. per sq. inch**
Elongation	**150 to 400 per cent**
Modulus at 100% Elongation	**500 to 1500 lbs. per sq. inch**
Tear resistance	**15 to 40 lbs.**
Specific gravity	**1.2 to 1.5**
Low temperature flexing limits	**0° C. to -60° C.**
High temperature operating limits	**60° C. to 80° C.**
Flame resistance	**Slow burning to self-extinguishing**
Color	**NEMA Standards**
Chemical resistance	**Inert to action of acids, alkalies and ordinary solvents**
Oil resistance	**Excellent (minute quantities of plasticizer extracted by volatile oils.)**
Weather resistance	**Excellent resistance to the action of sun, ozone and ordinary weather conditions.**

are protected by a jacket it has been possible to use at the most, two or three formulations for the so-called insulation requirements. For the jackets, on the other hand, it has been necessary to design more compounds to meet the more severe requirements of the individual applications. For low temperature portable cable service it has become necessary to supply somewhat softer materials containing special plasticizers so that the heavy wall thicknesses required in the jackets will flex without cracking. Unfortunately these plasticizers for use with resins on low temperature cables are somewhat more volatile at high temperatures and are not as flameproof as those plasticizers generally used on high temperature cables. In order to obtain flameproofness and to cut down the plasticizer loss at high temperatures most of the compounds designed for low temperatures are complex compromises. The problem of designing compounds for high temperature service has not been as complicated with respect to plasticizers but has introduced more problems involving the stability of the vinyl polymer itself. The highest approved operating temperature for continuous service using vinyl chloride polymers without protective coverings, is 80° C. Much higher intermittent temperatures are possible, but not recommended for continuous service. The intermittent temperature limits may be based upon the point at which excessive softening or deformation occurs and also the point at which excessive deterioration of the polymer is evident. Most of the compounds will not deform under moderate weight by more than 45% at 120° C. over a period of one hour. The electrical and chemical stability are probably less affected by temperatures of 120° C. than is the physical ability to resist deformation. Therefore, this physical deformation may probably be the best criterion of maximum intermittent operating temperatures for the simple insulated wire. This is not necessarily true of the more complicated types of cables where asbestos or glass are used as physical protection and as a part of the insulation.

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As is probably already well known, these vinyl chloride polymers and co-polymers are not affected by oxygen or sunlight or ordinary weathering to as great an extent as natural rubbers, nor are they affected by the ordinary acids and alkalies or even the strong acids such as chromic acid. Also they are remarkably resistant to the ordinary solvents and lubricating oils. They are softened somewhat by some lacquer solvents, aliphatic and aromatic ketones, acetic anhydride, aromatic amino compounds and some other organic compounds containing chlorine, bromine, or nitro groups. They may be hardened as a result of plasticizer extraction in high temperature air where the plasticizer is volatilized or in very high temperature water and other liquids where a leaching action occurs.

Because of the resistance to ordinary aging, the standard aging tests such as Geer Oven and Oxygen bomb tests are not significant except as a measure of the volatility of the plasticizer and the resultant hardening of the insulating compound. But here again this extraction occurs so slowly that tests have to be run 60 days at 70° C. to detect appreciably effects whereas with ordinary rubber compounds tests were normally run 7 to 14 days. Even after 60 days at 70° C. the tensile strength may be unaffected and the elongation may be reduced by only a few percent. It is therefore evident that ordinary aging means little to these materials and it is also evident that ordinary wire insulated with these vinyl resins will have a very long life. It should always be remembered however in installing and using wire insulated with thermoplastics that **they are thermoplastics** and their temperature limitations must be recognized.

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One of the most important of the physical properties of these vinyl chlorides is their ability to prevent the propagation of flame or to be self-extinguishing. Some of those designed for exceptionally low temperature work at -70° C. are not self-extinguishing but are better classed as "slow burning" as are some others designed for types of service other than for wire and cable use, but it is safe to say that most of the materials sold for wire and cable use do not propagate flame or are self-extinguishing. This exceptional quality has been one of the greatest factors in selecting these materials for Navy use. Because of this general improvement in flameproofness the Navy has designed more severe flame tests than those previously used by the industry. Eventually as these materials find their way into our homes the number of fires due to electric wiring faults should be decreased. This property has also made it possible to design electrically-wire-heated fabrics that were previously considered too dangerous for use.

C. Electrical Properties

BESIDE the exceptional physical properties which have made the vinyl polymers and particularly the vinyl chloride and copolymer types useful on wire and cable, these polymers possess an outstanding dielectric strength which may range from 400 to almost 2000 volts per mil of thickness depending upon the wall thickness tested and the type of test applied. A good average figure for ordinary wall thicknesses and average tests might be 700 or 800 volts per mil. This high dielectric strength has made it possible to use thinner walls of insulation, thus saving weight, cutting down space requirements, and generally making it possible to carry more power in a given size of conduit—an important factor in these days of increased motor and lighting loads.

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BECAUSE of the effect of temperature on the electrical properties of the thermoplastic vinyl polymers, it is best to show the power factor, dielectric constant and loss factor as a function of the temperature as seen in Chart I. The particular curves shown are for a standard insulating compound of vinyl chloride. As the curves indicate the power factor, dielectric constant and loss factor are quite low at temperatures of -40° C. but rise as the temperature increases. The power factor and loss factor reach respective peaks at approximately a power factor of .095 and at a loss factor of .55 at temperature values of 10 to 20° C. These latter electrical constants then decrease with increasing temperature and become quite respectable values at 70 to 90° C. This decreasing power factor and loss factor make it possible to use this type of insulation for heavy currents at ordinary voltages where the cable charging current is not the important factor that it is for very high voltage cables. But because of the relatively high dielectric constant high voltage cables operating at 70° C. would carry exceptionally large charging currents. This factor has thus far prevented the use of the vinyl chlorides as insulation on high voltage power cables, but has not prevented the use of these materials on 5000 volt airport lighting cables where the charging current may be tolerated because of the relatively short-time use of the cables.

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IT IS important to note that in the last few years research developments have increased the insulation resistance of these materials from values as low as a few megohms per 1000 feet at 60° F. to values now obtained commercially of 5000 to 10,000 megohms per 1000 feet on a No. 14 solid wire with 2/64 inches of insulation. These latter values are comparable with the better grades of natural rubber insulation.

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IT SHOULD be pointed out that the insulation resistance of these thermoplastics is affected by temperature changes: — for example a wire with an insulation resistance of 5000 megohms at 15.6° C. will have a resistance of approximately 5 megohms at 60° C. This resistance — temperature change follows a fairly straight line from 10° C. to approximately 90° C. Published data are available in the nature of temperature coefficients over the range of 10° C. to 32° C. which relate to the resistivity at 15.6° C. The question may also be raised as to what happens to the electrical properties after long periods in water. Actually after 60 days in water at 60° C. slight improvements in insulation resistance are sometimes found. The change in dielectric constant and loss factor at 25° C. in water is of the order of only 10 to 15% increase after 20 days immersion. The decrease in dielectric strength over the same period is approximately 10%.

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II. Uses

FROM the previous statements it may be imagined that the insulating and jacket uses for the vinyl resins on wire and cable would cover almost the entire field, with the exception perhaps, of the high voltage power cables and low-

(*Please turn to Page 672*)

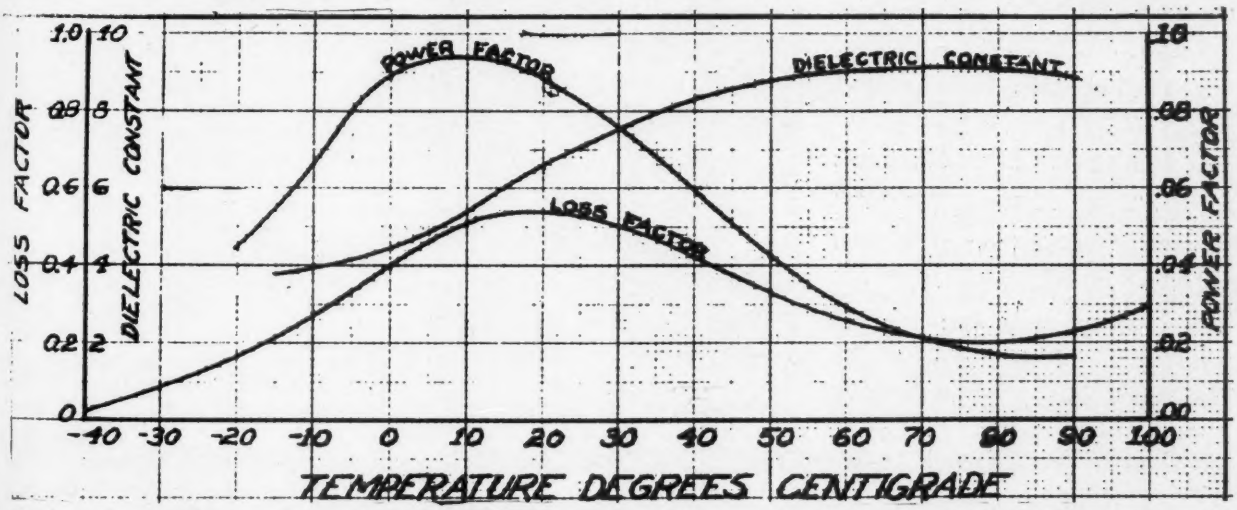

Chart I. Electrical Properties. Standard Vinyl Chloride Insulating Compound. 60 Cycles.

Extrusion of Vinyl Compounds In The Wire and Cable Industry

By H. K. Intemann,
Halowax Products Division, Union Carbide and Carbon Corporation,
New York, N. Y.

A discussion relating specifically to the application of the plasticized vinyl resins based on copolymers of vinyl chloride and vinyl acetate or on straight polyvinyl chloride to the insulated wire and cable field and reviewing the various pieces of equipment necessary to the extrusion of vinyl compounds and a discussion of certain operating conditions. ✦ ✦ ✦ ✦ ✦ ✦

ABOUT ten years ago several laboratories throughout the United States started experimental work on the application of elastic synthetic insulating materials for electric cable. These laboratories were looking for new outlets for plastics or for new dielectric materials for insulating purposes.

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SINCE that time a very large amount of experimental work has been done on the chemistry of plastics suited for use in the electrical cable field. You have heard about a small proportion of this work here today.

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THERE are a great many types of plastics which can be used in conjunction with cable insulation but so as not to confuse the issue this particular discussion is being limited to the application of certain types of plastics to the insulated wire and cable field — namely, the plasticized vinyl resins based on copolymers of vinyl chloride and vinyl acetate or on straight polyvinyl chloride.

✦ ✦ ✦

IN passing it might be of interest to review briefly the various means by which these materials can be applied in the manufacture of insulated cables. The three outstanding methods in their reverse order of importance are:

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In Liquid Form, By a Dipping Process

TO date this process is rather limited due to the uncompleted development work on the basic liquids to be used. Considerable work of good promise has been done and we can all expect to hear more about this method.

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By Taping

A CONSIDERABLE quantity of electrical cable is now being made by using tapes made from these plastics in various thicknesses and widths. They are being applied by standard types of taping equipment with which every cable process engineer is familiar and with which practically every cable company is equipped. Sometimes after applying these tapes the cable is subjected to a heat treatment so that a bond between the various layers results, but this is not necessary on many types of cables.

H. K. INTEMANN

For the past 14 years with the Halowax Products Division of the Union Carbide & Carbon Corp., and its predecessor the Halowax Corporation with activities relating entirely to the development of materials and processes for wire and cable application at the Bloomfield Development Laboratories and later in the field doing engineering work with users of their products. Since 1940 in charge of sales and engineering for the division.

✦ ✦ ✦

By Extrusion

THIS is the most important method of insulating wire and cable with vinyl plastics. It is the purpose of this paper to review this process with the idea of reporting on the development of the art, of developing discussion, and to plant the seed for further development of methods of applying these plastic materials to wire by some form of continuous molding or extrusion.

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IN the early days of the extrusion of thermoplastics on wire and cable an attempt was made to use the conventional rubber extruder.

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THE screw type extruder is essentially a machine having a horizontal cylinder in which is rotated a modified Archimedean screw. The cylinder is jacketed for circulation of a heat-transfer media and in most cases there was no provision or channelling in the attached head for controlling and obtaining an independent uniform head and die temperature. Mate-

rial fed at the feed section when carried along the screw was heated by coming in contact with the barrel and made partially plastic by working the compound under the back pressure created. The material was forced into the head and through the tubing die. As feeding cold or room temperature stock to the extruder was unsatisfactory, an attempt was made to extrude by preheating the stock in an oven. It was soon found that, although some advantage was gained by oven-preheating, it was necessary to prework the stock on a mill in order to create sufficient plasticity or flow in the compound so that when it was fed to the heated extruder the worm would convey the material to the head and die in a homogeneous state. Without the preworking, semi-plastic particles would ride in the somewhat plastic mass and would form lumps, or pinholes, and would result in spark failures on the wire. With rubber tubers and by oven heating, there was insufficient frictional working of the compound. Another disadvantage of the rubber extruder was that the side-delivery head most commonly used for wire insulation was not streamlined. Thus, pockets of material were formed and eventually difficulty was encountered through decomposition of the pocketed vinyl compound. It was also a difficult machine to clean.

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THE manufacturers of extruders, as well as the plastics manufacturers, were quick to realize the desirability of developing a new tuber. Through their mutual co-operation the new plastic extruding machines have been developed. The main differences between the rubber extruder and the plastic machine are: the cylinder and screw are approximately one-third longer; provisions have been made for the insertion of a breaker plate and screens; and the thrust sections are more ruggedly built so as to absorb the increased back pressure developed, which, in turn, creates greater frictional working, plastic flow, and uniformity.

THE cylinder of the plastic extruder has gone through many changes and is still in the development stage, but before going further in the discussion it should be considered that any plastic screw extrusion machine accomplishes its purpose only by the differential of the frictional forces exerted by the material on the screw and against the cylinder wall. For this reason every effort is exerted to decrease the frictional force on the screw and increase that force on the cylinder wall, concurrently maintaining a suitable state of plasticity.

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THE materials of construction of the screw and barrel play a significant part. These parts must withstand severe mechanical forces and should exert no specific catalytic effect on the decomposition of the compound being extruded. For this reason cylinders made of hardened corrosion-resistant ferrous alloys, having a Rockwell hardness on the C scale of about 68, are most desirable. The cylinder wall should not be chromium-plated because such plating is likely to chip off and cause scoring. The screw should be of stainless steel, or a tough, rigid steel, and may be used and chromium-plated on all frictional areas, but not on the lands which may contact the walls. It is important to have the land hardfaced with a material such as Haynes Stellite alloy.

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EITHER single or double lead screws may be used for extruding vinyl resin compounds. In general, the only difference in results with the two types of screw is a somewhat higher extrusion pressure in the case of the single lead type and, contrary to rubber practice, single lead screws may be used without danger of marking the extruded product. Screws designed with a decrease in pitch from the magazine end to the die end are preferred to constant pitch screws because the former develop greater pressure.

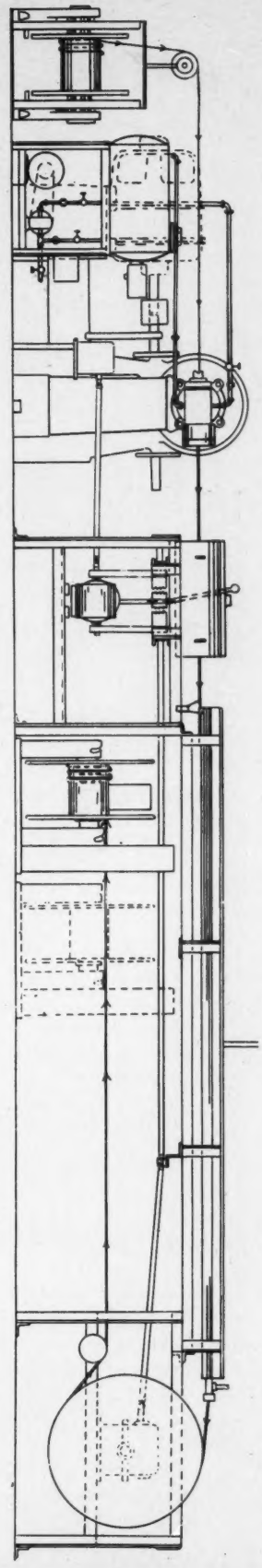

Fig. 1. Typical setup for Resin Insulation.

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(3) Making complete installations in new mills and instructing their personnel in recutting, also in finishing from rough-cored dies.

A typical customer's appraisal of FIRTHALOY Service was written by a works manager: **"The boys tell me that he** (a Firthaloy Service Man) **taught them more in the two days here than we've learned elsewhere in the past four months."**

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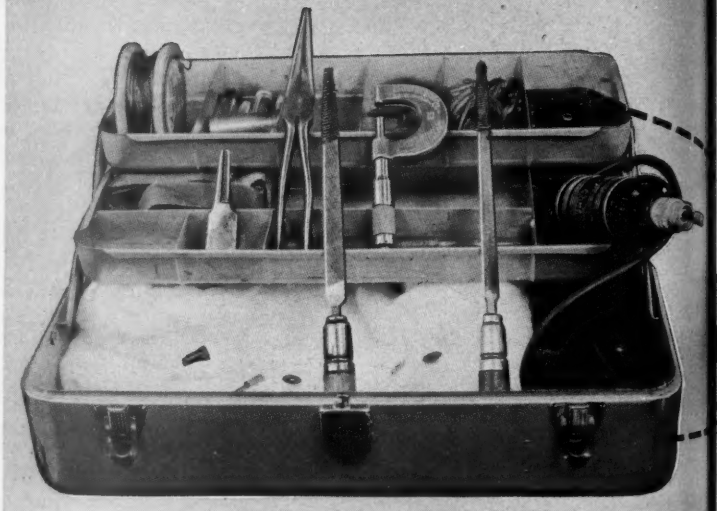

***Above*—Working kit of a typical FIRTHALOY Service Man—member of a highly efficient staff that is devoted to increasing war production.**

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Nail Mills
Tube Mills
Cold-Drawn Plants
Welding-Rod Manufacturers
Bolt, Nut, Screw, and Rivet Makers
Spring Manufacturers
Textile Manufacturers
Ammunition Makers
Metal-Forming Plants
Wear-Resisting Parts Users
Roll Users
Bushings Users
Etc.—Etc.—Etc.

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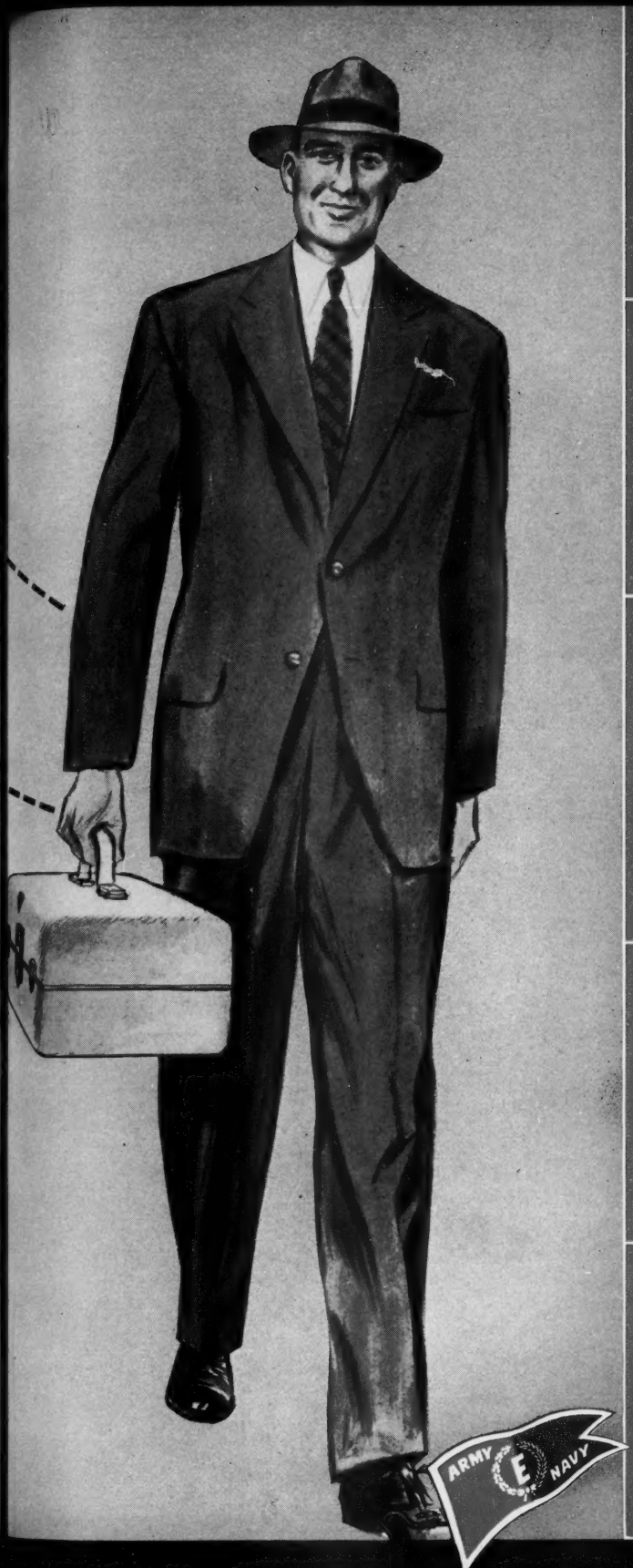

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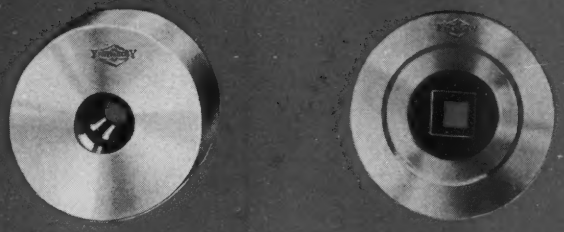

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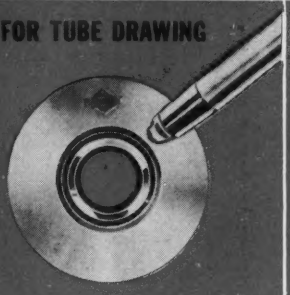

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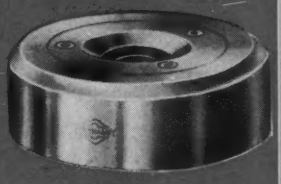

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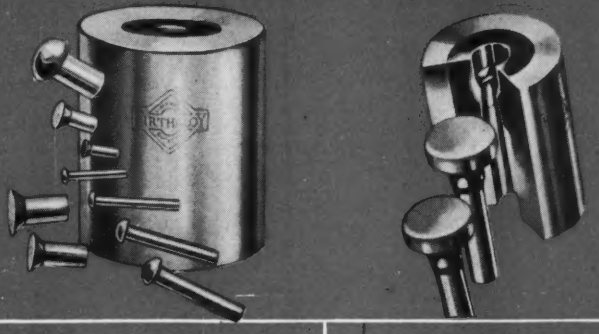

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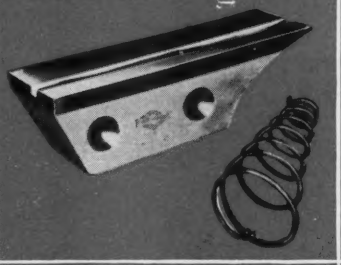

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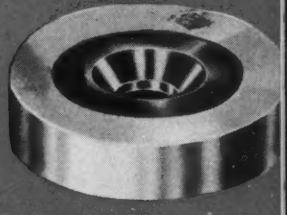

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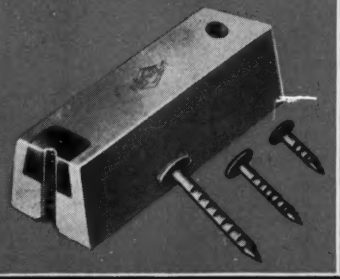

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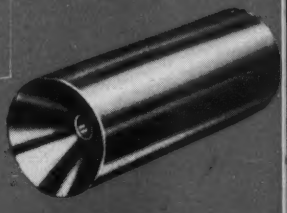

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THE matter of clearance between the screw and wall of the cylinder is extremely important, because of the relation between this clearance and pressure developed. This clearance should preferably be .005 inch on each side of the screw, and in no instance in excess of .015 inch on each side. Greater clearance between the screw and cylinder wall allows the material to wash back over the screw, resulting in loss of extrusion pressure and consequent slow, non-uniform and even non-delivery of extruded product.

✦ ✦ ✦

OPTIMUM rotational speed of the screw varies for different die shapes, sizes, and compounds, and for this reason variable speed drives are most desirable. In general, however, the preferred screw speed for processing vinyl resin plastics is 12 to 50 r.p.m.

AUXILIARY, but none the less important, accessory equipment includes means for turning the screw at optimum speed and for accurately maintaining proper temperature relations on the die, cylinder, and screw during the course of the extrusion process.

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FIGURE 1 illustrates a typical complete setup for resin insulation.

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ALTHOUGH the side-delivery head and die design have been greatly improved in recent years by greater streamlining of the compound space in the head and of the wire guider, it is felt that there is need for still further improvement. This is true especially for the correlation of effect of compound space on the back pressure in the barrel for different size tubers, and the more complete elimination of dead spots in the head. This also ties in with design and efficiency of the bleeder, which at the present time has a tendency to clog, and which will affect centering and may show up as rough spots on one side of the insulated wire.

✦ ✦ ✦

THE use of breaker plates and screens in a plastic tuber is usually desirable to effect uniform plastification of material passing through the extruder. This is permissible with these vinyl materials because of their fundamental flow behavior.

✦ ✦ ✦

THE size and design of the breaker plate used, of course, depend on the make and size of the tuber. A 4-inch diameter strainer plate with a 3-¼-inch working diameter, and having thirty-six ⅜-inch, or ninety-six ⅛-inch diameter uniform bore holes, will produce good results

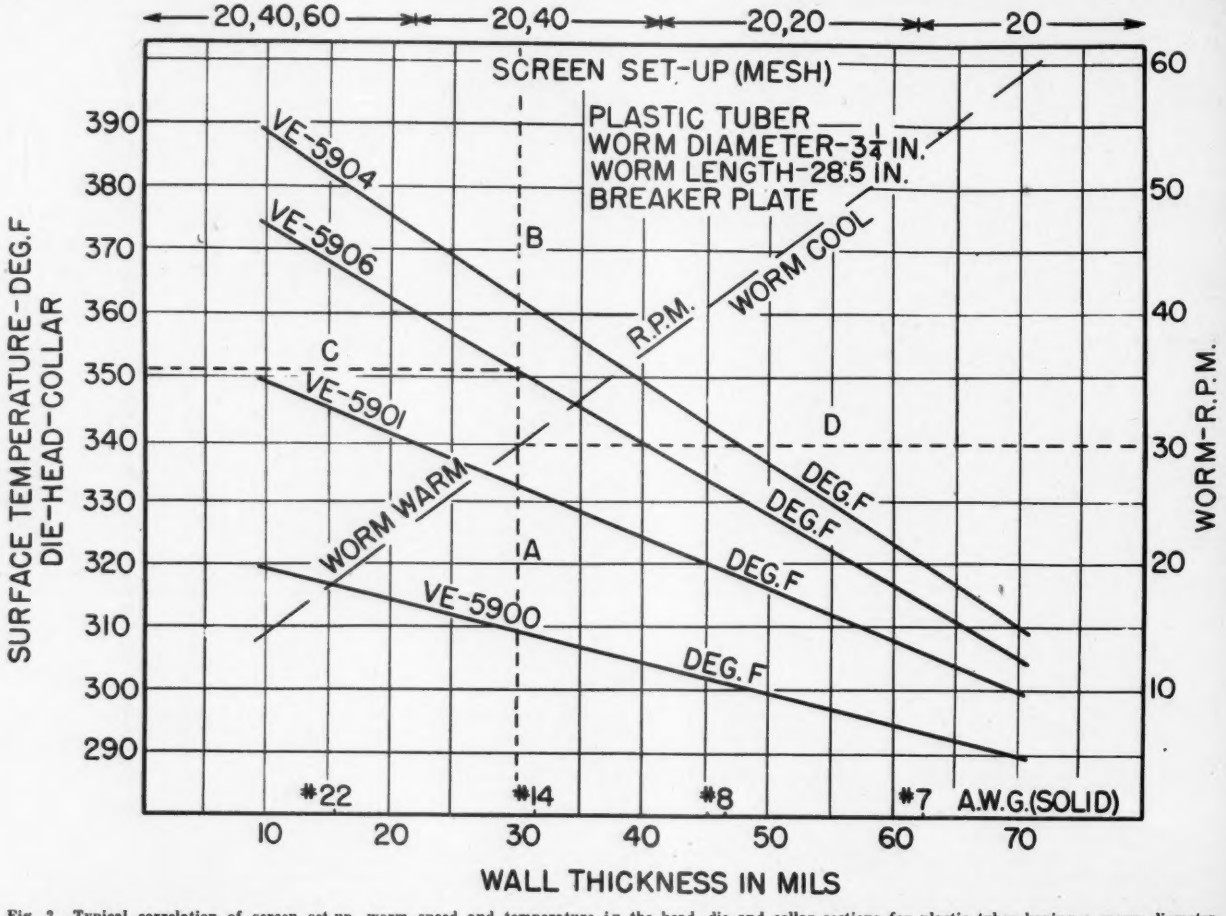

Fig. 2. Typical correlation of screen set-up, worm speed and temperature in the head, die and collar sections for plastic tuber having a worm diameter of 3¼" and 28½" long.

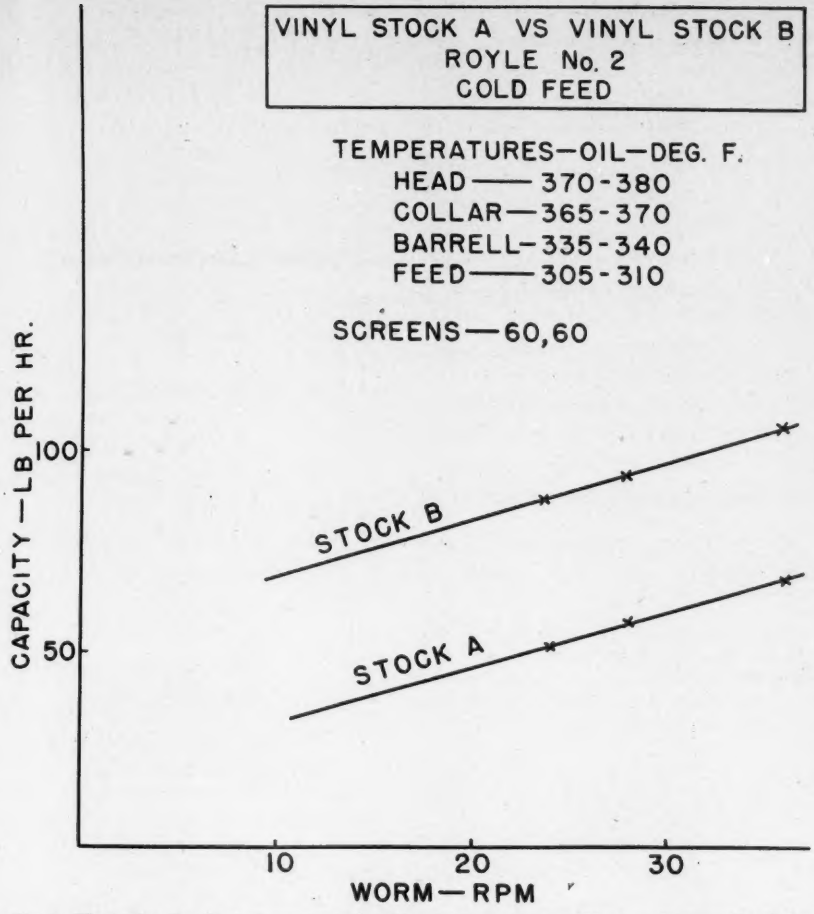

Fig. 3. Illustrating the effect of worm speed under set temperature conditions on the capacity of the extrusion machine.

when used in a machine with a screw of about 3¼-inch diameter. The strainer plate may be chromium-plated. Screens of various mesh and wire sizes can be used in combination with the breaker plate. One 20-mesh, steel wire screen used with the breaker plate aids in obtaining satisfactory delivery speeds with good quality product for larger size insulated wires. Finer screens may cut down the delivery rate on the large sizes of wire. Fine mesh screens up to 60 mesh can be used along with coarser mesh screens when extruding a thin wall on small gauge wire without loss of head pressure, and without sacrificing tubing speed.

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Operating Temperatures

THE barrel of a plastic extruder is usually divided, for temperature control purposes, into two zones of approximately equal length. Some machines include a water jacket for cooling the feed opening to prevent "bridging" of the feed material at that point. Furthermore, some machines have provisions for separate temperature control at the head or the region between the delivery end of the screw and the die holder.

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STEAM or hot oil is the customary means of heating the barrel. Where steam is used, accurate, differential temperature control on various parts of the machine may be effected through the use of pressure regulating devices. If circulating oil from a common source is used, differential temperature control on the various extruder sections can be obtained by throttling the inlet valves to the various sections to the desired point. Some machines incorporate separate circulating oil systems,

(*Please turn to Page 645*)

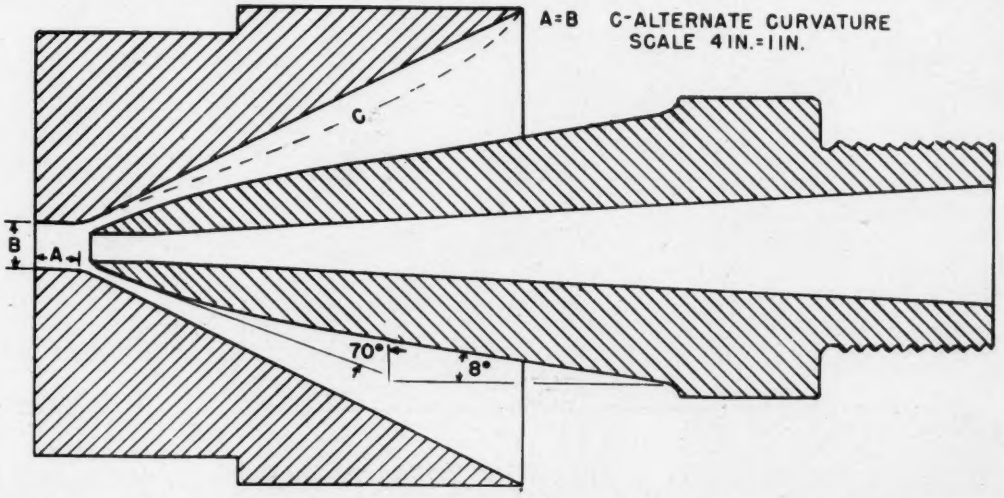

Fig. 4. Bearing lengths of forming die and its relations to the diameter of the die for sizes up to ½" in diameter.

Fiberglas As An Electrical Insulation

By L. T. Russell,
Electrical Engineer, Product Development Dept.,
Owens-Corning Fiberglas Corp., Newark, Ohio.

The use of fiberglas for electric wire and cable insulation is a comparatively recent development. The author presents concrete and interesting information on the process of manufacture and the many uses of fiberglas as a special purpose insulation for electric wire and cable. ✦ ✦

Introduction

THE story of Fiberglas goes back to a milk bottle. In 1931 a better method of applying stencils to milk bottles was being investigated in the laboratory. Among the many ways being tried was one similar to that of spraying paint. In this spraying process, some beautiful fibers of glass were formed. Further experiments revealed that these fibers were not only novel, but could be made practical, and an intensive study was begun.

✦ ✦ ✦

A FEW men of vision saw the possibilities of a new and revolutionary industry developing from these fibers of glass and had the courage to carry on the work. The first application of these fibers was in a replaceable type air filter. That was in 1931; today there are 380 separate Fiberglas products. The first fibers were coarse, like broom straws; today fibers are being made so fine that a mat of them takes on some of the characteristics of rubber.

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Types

BASICALLY, Fiberglas is made in two different forms. The first is a wool-like material and the second is a textile fiber. The wool form may be further sub-divided into three classifications according to the size of the fiber.

1. The coarsest fibers are used for air filters.

2. A finer fiber is used in many forms for heat and cold insulation. This thermal insulation may be used as a white fleecy cotton-like bat or may be bonded to give a semi-rigid or rigid board, depending on the application.

3. A still finer fiber is made into a bonded sheet and serves as a retainer mat for keeping the active material on battery plates.

THE textile fiber can also be divided into two classifications:

1. A continuous filament textile, the length of which is dependent only upon the package, and

2. A staple fiber textile which has an average length of about 15 inches.

LESTER T. RUSSELL

Lester T. Russell was born in Warren, Ohio, on July 27, 1910. In 1933 he was graduated from Purdue University with a B.S. degree in Electrical Engineering. He then spent five years in the research laboratories of the Incandescent Lamp Division of the General Electric Company at Nela Park as an engineer doing development work on new methods and materials for lamp making. Some of this work included research on the Lumiline and flourescent lamp. Following this he worked as quality control engineer in two of the General Electric lamp factories. He has been associated with the Research Laboratories of the Owens-Corning Fiberglas Corporation in Newark, Ohio, since January, 1942, as an electrical engineer in their Product Development Department. He has worked on new applications of Fiberglas for electrical insulation of cable and equipment especially for high temperature uses in combination with new resins.

BOTH textile fibers may be twisted and plied into a large number and variety of yarns and threads which subsequently are used to make fabrics of any weave on standard textile looms.

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Manufacturing Processes

ALL the basic fibers are made by drawing the molten glass through tiny holes as it issues from the glass melting tank or furnace. In the wool making process, the batch material is charged into one end of a conventional glass melting furnace which holds as much as fifty tons of glass. The molten glass issues from the forehearth at the other end and is drawn into fibers by high pressure air and steam. The fibers are blown down upon a conveyor which collects it as a blanket. A lubricant is sprayed on it, and then, depending on its ultimate use, it is treated in various ways. A binder may be applied, and it may be compressed to various densities and thicknesses. It may be used with or without a cover or further processed to fit special applications.

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THE textile fiber-making process is different because the glass is first made into marbles. This is done for the purpose of refining the glass and inspecting it carefully for cords and seeds. This method of pre-forming into marbles gives the necessary delicate control for making fiber of the highest quality. The inspected marbles are then melted electrically and pulled into fiber. Continuous fiber textile is attenuated mechanically. The glass is actually yanked through the tiny orifices

and wound on bobbins at a speed of over a mile a minute.

✦ ✦ ✦

THERE are 102 or more orifices in each unit. Therefore there are 102 or more continuous fibers which go to make up the single strand of thread. These are all collected and a binder applied which holds them together as a single thread.

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THE staple fiber textile is also made from the inspected marbles. The marbles are melted electrically, but the fiber is drawn from the orifices by high pressure air or steam instead of being pulled mechanically. It is then sprayed with lubricant and collected on a large rotating drum where it is drawn off as a sliver, (pronounced (sly'ver).

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Properties

THE glass fibers retain the well known properties of glass, but also take on new properties which give the product new usefulness. The fibers are inorganic, therefore do not burn. They do not absorb moisture and will neither stretch nor swell. They are likewise rot and vermin proof and are unaffected by oils and most acids.

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FLEXIBILITY is the most distinguishing property of Fiberglas because the fibers are incredibly thin in relation to their length. The fiber most generally used for continuous textile fabrics is about .00023 of an inch in diameter, but this dimension can be varied considerably either way to give the characteristics desired.

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AT the same time fiber size goes down, the tensile strength per unit of cross section comes up. Fibers averaging .00023 of an inch in diameter have a tensile strength of more than 250,000 pounds per square inch. Although steel is the engineering material usually considered as the symbol of strength, glass fibers possess a far greater strength to weight ratio than steel. Indeed, glass fibers develop a greater strength to weight ratio than any known commercial material, either natural, or made by man. Tensile strength of 2,000,000 pounds per square inch has been calculated in the laboratory on very fine fibers. Since the glass fibers do not burn, they still retain over half of their unusually high tensile strength even at a temperature of 800°F.

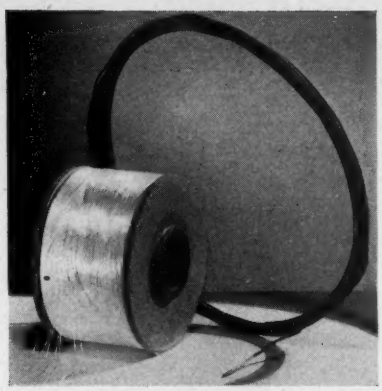

Fig. 1. Coil of Fiberglas insulated magnet wire and a tube of multiple wound Fiberglas yarn, the type used for applying to magnet wire. ✦

✦ ✦ ✦

GLASS is fundamentally recognized as a hard and durable material with considerable ability to withstand abrasion, but at the same time it is also well known that glass will scratch glass and cause it to break. Nevertheless, when the surface is protected by a proper material, such as a lubricant or a suitable resin, it will not scratch and break. Fiberglas is, therefore, never used alone. It is always used with other materials. It is given a treatment in the form of a binder as it is manufactured. The user must further impregnate it so that his finished goods will produce the ultimate in usefulness and electrical qualities.

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ORDINARILY we think of glass as being very stable. From 3000 to 5000 years ago, the Egyptians made glass jewelry which is still in an excellent state of preservation. Many stained glass windows, still in existence, date back to the early Venetians. These samples have withstood the ravages of time without showing visible signs of disintegration, but all have weathered and are minutely lighter than they were originally. When we make glass fibers of such extremely fine size, their exposed surfaces are immensely increased, and weathering becomes of definite concern. It is therefore important that Fiberglas be made of the very highest grade glass. A vast amount of technological glass research has been carried on by our laboratory to develop the particular glass formulae from which Fiberglas is made.

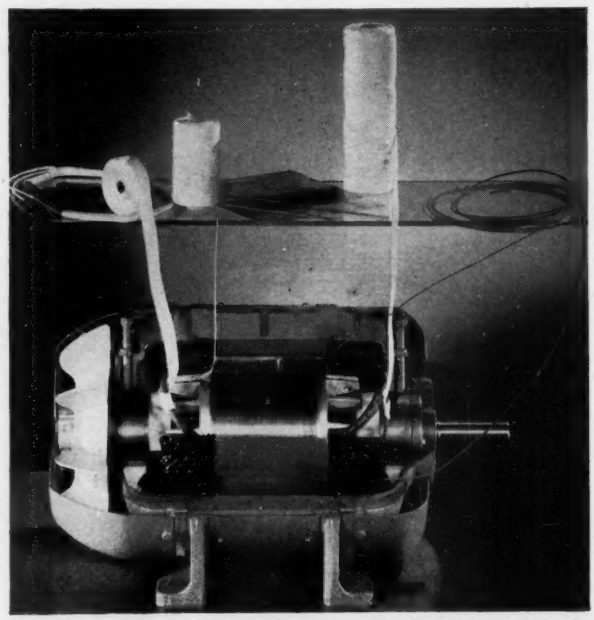

Fig. 2. Some of the more common uses of Fiberglas insulation in a motor. On the shelf to the left is a motor coil made of Fiberglas insulated magnet wire and wrapped with Fiberglas tying cord. In the center is treated sheet material used for slot phase or ground insulation and samples of varnished tubing. To the right is a tube of Fiberglas sleeving, a coil of Fiberglas insulated magnet wire, and a coil of Fiberglas insulated lead wire.

✦ ✦ ✦

SINCE all the fibers are solid glass rods, they do not absorb moisture, but water will wet their

surface and cause capillary action in the yarn if it is not treated. This is another reason why Fiberglas electrical textiles are never recommended for use without a resin or varnish impregnation, except on rare occasions.

✦ ✦ ✦

ALL users of Fiberglas can take advantage of its remarkable qualities and utilize its desirable properties, if they fully understand how other materials should be used with it. The proof of this lies in the fact that today, Fiberglas is doing the extremely tough jobs and is reserved for use where other materials are inadequate. Before 1937, Fiberglas was being tried experimentally by only a few people; today there is scarcely an electrical manufacturer who is not using it in large quantities for definitely proven and extremely vital purposes.

✦ ✦ ✦

Uses

THE unusual properties of Fiberglas are recognized as being especially suitable for the electrical industry. It is used in one form or another in practically every phase of the industry. The forms most generally used are yarn, tape, sleeving, cloth, varnished cloth, tension cord, tying cord, mica backing and laminates. The untreated fabrics are furnished to standard specifications and we supply yarns on serving cops and braider tubes directly to the wire users from our factories. In the past five years. the number of pounds of Fiberglas used for the electrical industry has been multiplied many times. At present, WPB allocates the entire production. To take care of this increase, the plant at Newark, Ohio, has been expanded; a new plant in Rhode Island began operation the first of last year; another new plant in Pennsylvania will start to operate by the end of this year.

ONE of the first uses of Fiberglas was for covering magnet wire. The yarn is served on the wire in the conventional manner. At first it was used like cotton or silk without a varnish treatment. Largely through the efforts of the cable manufacturers this procedure has been changed and the wire is now impregnated immediately after serving. This method has been a definite step forward, because the magnet wire user is now guaranteed both a more thorough and complete impregnation, and a wire which will withstand severe abuse.

Fig. 3. Large size magnet wire properly insulated with continuous filament yarn has the toughness to meet the sharp edgewise bends required in this Roebel transportation. ✦ ✦

FIBERGLAS in its wool-like form is an excellent heat insulator; in its more dense form on magnet wire Fiberglas has high heat dissipation and reduces hot spot temperature by readily carrying away the heat.

✦ ✦ ✦

THE dielectric strength and moisture resistance of all types of textile covered magnet wire is dependent upon the degree of completeness of the impregnation. A factory impregnated magnet wire is an additional safeguard against voltage breakdown. Fiberglas offers the distinct advantage of a textile which inherently has high dielectric strength and is unaffected by moisture.

✦ ✦ ✦

BECAUSE of its less bulky nature, Fiberglas covered magnet wire is used in Class B and Class C type motors where small space factors are needed. This, together with its other properties, allows smaller and smaller motors and generators to be built with the same performance and output. It is also used in place of organic insulation for Class A equipment where an added factor of safety is needed for emergency overloads. A factory treated magnet wire will withstand unusual abuse. It is now possible to give a rectangular wire sharp edgewise bends for Roebel transposition windings. These windings are used in high voltage motors and generators to equalize internal voltages which cause eddy currents. It is no longer necessary to insert varnish cambric in these bends to prevent shorts. This means a substantial saving in space factor.

✦ ✦ ✦

FIBERGLAS is used to insulate transformers and increase their ratings without increasing their size. The "dry core" transformer is one which has been developed to operate at higher temperatures and eliminate the need for oil cooling. Fiberglas permits this higher temperature and makes possible a smaller unit.

✦ ✦ ✦

Fig. 4. Some Fiberglas insulated products. ✦ ✦ ✦

IN innumerable ways where weight and space are of principal consideration, aircraft electrical equipment uses Fiberglas. In the compact amplidyne armature a single Fiberglas braid covers a number of conductors grouped together to form one turn. This allows the maximum copper to be used in the minimum space, thereby increasing the output for a given size and weight. Other aircraft uses in-

(*Please turn to Page 670*)

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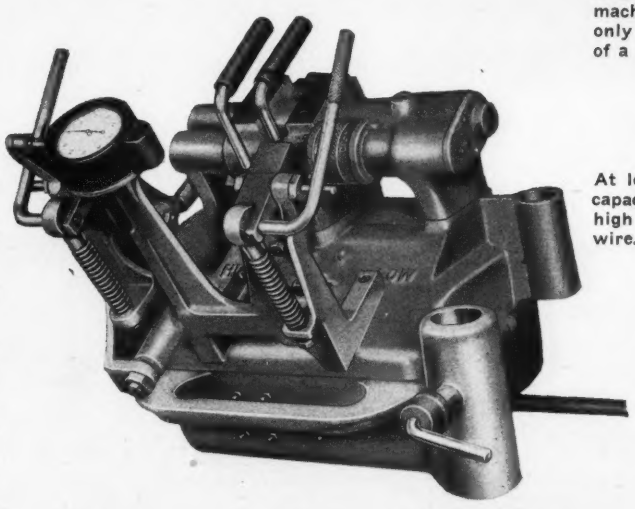

At left — Model E; capacity .034" to .225" high and low carbon wire.

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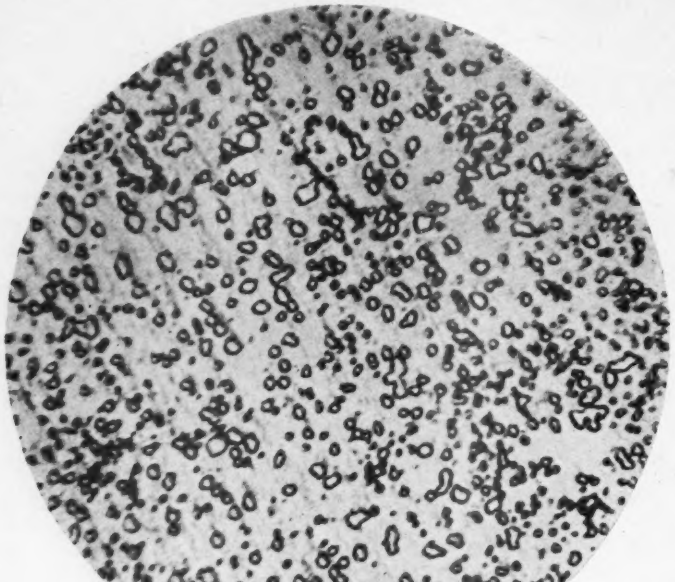

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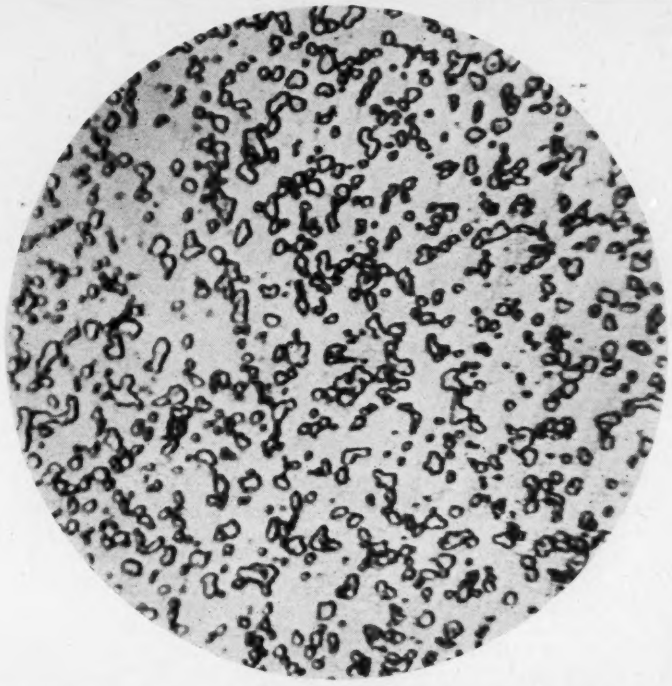

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Announcing Organization Meeting of the Pacific Coast Chapter of the Wire Association

The Organization Meeting of the Pacific Coast Chapter of the Wire Association will be held at the Francis Drake Hotel, San Francisco, California, on Friday, October 29th, 1943.

At this meeting the Chapter will proceed with its organization and election of Chapter officers. There will be a Luncheon and a Program of interesting technical papers with open discussions.

✦ ✦ ✦

The Executive Secretary of the Wire Association, Richard E. Brown, and his assistant, Mrs. R. S. Spengel, both of WIRE & WIRE PRODUCTS, Stamford, Conn., will be present to assist in the organization activity and to outline the activities and benefits of membership in the Wire Association. Membership includes the following:

1. **Question and Answer Service. Answers to technical and operating problems direct by mail. Available to members only.**
2. **Annual Convention and Exhibition. (In association with American Society for Metals and The National Metal Congress.) Technical Sessions, Plant Inspections.**
3. **Regional Meetings. Attendance at the regional meetings which include Local Plant Inspections. Sessions and Discussions.**
4. **Personal Contacts. Both at Annual and Regional Meetings, and throughout the year, for interchange of helpful information.**
5. **Information Service on Machinery, Equipment and Supplies. The Technical, Catalog and Correspondence Files of the Wire Association hold the answer to practically every "Where can I buy" problem. This service is available to members without charge.**
6. **Wire & Wire Products—For one Year. The official publication of The Wire Association, covering the Wire Industry, its Metallurgy, Technology, Research, Processes, Machinery and Personnel.**
7. **The Annual Buyers Guide & Year Book of the Wire Association. The Year Book Section contains: Constitution and By-Laws of The Wire Association; Details of year's Meetings, etc.; List of Members, Index to Papers and Articles in WIRE & WIRE PRODUCTS.**

✦ ✦ ✦

The Organization Committee of the Pacific Coast Chapter of the Wire Association consists of the following:

Earl R. Potter, Supt., Standard Wire Division, California Wire Cloth Corp., South San Francisco, Calif., CHAIRMAN.

K. H. Davis, President, K. H. Davis Wire & Cable Co., Los Angeles, California.

Emerson Spear, Vice President, Pacific Wire Rope Co., Los Angeles, California.

Ray D. Mack, Pacific District Mgr., Carboloy Co., Inc., Los Angeles, California.

Harry T. Hartwick, Service Engineer, Firth-Sterling Steel Co., Los Angeles, California.

T. H. McSheehy, Sales Representative, Wickwire Spencer Steel Co., San Francisco, California.

Richard E. Brown, Executive Secretary, The Wire Association, Stamford, Connecticut.

This is an invitation for you to be present at this meeting and to become a member of the Wire Association and participate in its activities.

THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

300 MAIN STREET **STAMFORD, CONN.**

High Tensile Bolt Production

ARISING out of difficulties encountered in supplies for the production of high tensile bolts, a Wire Association member in England requested light on his problems from other members, the result of which may be of interest and value to others. His problem was stated in a letter received earlier this year:

✦ ✦ ✦

"The matter in question concerns the production of high tensile bolts on both Double Blow Cold Headers and National Boltmakers. We are using two types of Steel wire for these bolts and they are shown in Tables I and II.

The Wire Association is for the specific purpose of improving production methods. It has been organized as a clearing house of ideas on technical problems and research work in all phases of practical wire drawing and wire working.

The inquiry discussed here was received from and answered by members of the Wire Association. These inquiries are sent to the Secretary of the Association who acts as a central clearing point, and neither the names of the firms, or individuals sending in the inquiry, or of the men or firms replying are divulged without permission.

TABLE I

Wire for 45/55 Ton Tensile Bolts.		Straight Carbon Steel to following Analysis.
.31/.35%	Carbon	Main Use: Vehicle and Tank Bolts. Wire Drawn from normalized rods; deformation 8/12%.
.65/.80%	Manganese	
.18/.25%	Silicon	
.04% Max.	Sulphur	
.04% Max.	Phosphor	

TABLE II

Wire for 55/65 Ton Tensile Bolts. Carbon Manganese Molybdenum Steel to following Analysis.		
.36/.42%	Carbon	Main Use: Aircraft bolts and subject to crack detection tests. Wire drawn with a heavy draft from rolled rods, then spheroidized and finally drawn with 5% deformation to finished size.
.85/1.00%	Manganese	
.30% Max.	Silicon	
.25/.35%	Molybdenum	
.04% Max.	Sulphur	
.04% Max.	Phosphor	

The trouble we are experiencing with these two classes of wire is a considerable percentage of cracked heads developing in the heading process on both types of machine, which results in the necessity for 100% inspection on the finished bolts with rejections ranging, in various parcels, from quite small percentages (say from 1% to 5%) to, in some cases as much as 33⅓%.

We, naturally, have investigated the cause of this trouble, and it is agreed between our own metallurgists and those of our own steel and wire mills, that in the main the defects arise from roaky ingots, with occasional lapping in the billet or rod rolling.

We at the finishing works take the view that we are entitled to expect to receive wire which will yield 100% good bolts; but the view of the steel-making and wire-drawing side of our organization is that it is impossible for anyone to guarantee to produce wire of such consistent soundness; and that we should be prepared to accept wire yielding a small percentage of defective bolts (cracked heads and shanks) and to arrange for their elimination from the finished product by 100% inspection.

When in America in 1939, my colleagues and I investigated this particular problem; in fact, that investigation was the main object of our visit. We came away from extensive visits to steel, wire and bolt making plants with the distinct conviction that both in Canada and the States, control of steel and wire production had been developed to such an extent that such troubles as we are now experiencing are practically unknown over there; we reported this with a wealth of detailed practice gathered from the numerous plants visited as a guide to our own steel and wire mills for the future.

At ———, where we produce bolts by cold processes from ¼" to ¾" in diameter, we find generally speaking, that troubles are more frequent in sizes over ⅜" diameter. At our ——— Works, where production is in the main confined to sizes below ½" diameter, with a preponderance of sizes less than ¼" diameter, they experience very much less trouble than we do at ——— in respect of cracked heads.

Of course, War conditions have caused many difficulties in steel production, ores are not so pure, Spiegel-Eisen is improcurable, and so on; but our view is that even if a cast of steel does not come up to standard, there is no sound reason why it should be processed to the wire stage, there to find it is un-usuable owing to roakes, splits, laps or other defects; and even if, inadvertently, it does reach the stage of finished wire, my recollection of American wire inspection methods leads me to believe that inspection and control from ore to wire is so comprehensive there as to practically eliminate the possibility of defective wire getting through the various processes to the ultimate user.

Do you think it possible to obtain categorical replies to the following questionnaire from any of your members intimately connected with the problems here set out?

1. Do you experience regular and repeated difficulty with wire, especially in the two classes cited earlier in this letter, through roakes and surface defects in the wire leading to serious cracks developing in the heading process?

2. If the answer to (1) is "yes", do you practice 100% inspection of the finished bolts, in order to ensure that only sound bolts are despatched to users?

3. If the answer is "no" can you inform me of the steps taken in casting, blooming, billet rolling, rod rolling, wire drawing, etc., to ensure 100% sound wire?

4. Does intermediate heat-treatment of rods or wire have such bearing on the ultimate surface quality as to lead to the elimination of serious surface defects in wire; or alternatively to the easing of the tendency to develop slight surface defects into serious cracks on heading, which might ultimately be so slight as to be permissible in bolts not subject to crack detection?

5. If you do regularly experience cracking of heads due to wire surface defects, do you consider it impossible to eliminate the source of the trouble, or alternatively if you do not suffer from the defects mentioned, do you consider it should be possible in this

country to reach the same stage of perfection which we believe existed in America prior to the War, taking into consideration our difficulties with ores, etc.

6. Can you say how far casting pit and ingot mould practice is responsible for the initial development of roaky steel, and what steps are necessary to ensure the production of sound ingots free from surface defects?"

✦ ✦ ✦

A NUMBER of responses to this question were received which are quoted:

✦ ✦ ✦

Answer No. 1

"ALL blooms and billets should be reconditioned by chipping or scarfing to remove all surface defects before rolling into the finished size. If defects are excessive in blooms or billets it then is a job for the steel maker."

✦ ✦ ✦

Answer No. 2

"AS a builder of Cold Headers, I would draw the conclusion that the wire that they are using is too hard and should be thoroughly annealed when put into the Cold Header and then after heading heat treated for the desired result. My experience has been in cold heading, that when the material cracks in upsetting the head, invariably the wire mill man will agree that the wire is too hard and must be supplied thoroughly annealed. This usually overcomes the difficulties, providing that the mill exercise caution in not allowing seams to appear in the skin surface of the wire."

✦ ✦ ✦

Answer No. 3

"I HAVE viewed the questions which a British member of the Wire Association has sent to you in connection with high tensile bolts and bolt wire. It is very difficult to provide a really satisfactory answer to the several questions that have been raised by our friend on account of the fact that I am not at all familiar with British practice in the production and use of this class of wire product, especially as regards inspection standards. However, the following comments are offered for what they may be worth.

I KNOW of no product manufactured in our wire mills in this country that is subject to more discussion and a greater divergence of opinion between the steel maker and the user than cold heading steel. In most instances the cold heading operations are so severe that practically a perfect surface quality is required even in low carbon steels, and, of course, the effect of very slight surface imperfections is greatly exaggerated in the higher carbon grades which are the subject of this inquiry. As a consequence, of this, I am afraid that our British member may not fully appreciate the fact that this particular class of product is troublesome with us as well as with those manufacturers in Britain.

✦ ✦ ✦

WHILE we use somewhat similar grades to those listed in this inquiry, they are not quite identical. For example, the steel that is largely used in this country which would compare with No. 1 in the questionnaire is the American Iron & Steel Institute Standard Grade C 1030 which calls for: Carbon .28/.34, Manganese .60/.90, Phosphorus .04 Maximum, and Sulphur .05 maximum. It will be noted that a Silicon requirement is not listed, and when it is specified in this country I dare say that as a rule the range would be of the order of .07/.15 or .10/.20. Personally, I am not in favor of as high a silicon as .18/.25 as appears to be used in Britain. In my opinion this higher silicon does not help the hot rolling qualities of the steel, (in fact, it may detract from those qualities), and I believe that it definitely is a disadvantage in cold heading. I would much prefer to see the silicon maintained considerably below .20 and use a little aluminum to complete the deoxidation in the steel mill.

TABLE III

Grade	Carbon	Manganese	Phosphorus Maximum	Sulphur Maximum
C 1038	.35/.42	.60/.90	.04	.05
C 1040	.37/.44	.60/.90	.04	.05
C 1041	.36/.44	1.35/1.65	.04	.05

THE steels employed here which might compare to No. 2 which is indicated in this questionnaire will be C 1038, C 1040 and C 1041 which carry the compositions shown in Table III.

✦ ✦ ✦

IN addition, especially for aircraft bolts and superseding SAE 2330 steel which was formerly used, we are now using American Iron & Steel Institute Grade A 4037 which calls for: Carbon .35/.40, Manganese .75/1.00, Phosphorus .04 maximum, Sulphur .04 maximum, Silicon .20/.35, and Molybdenum .20/.30. All of these grades should be spheroidized and the finishing draft in the wire mill should be kept just as low as possible in order to provide a coating on the surface of the wire. Here again it is my personal opinion that it would be well to keep the silicon content of the steel on the low side.

✦ ✦ ✦

IN the steel plant the billets certainly should be very carefully prepared before rolling into rods and all surface defects removed. It is also equally important that the annealing be very thorough.

✦ ✦ ✦

IT has been my experience that the quality of workmanship of the bolt plant and the technique and skill employed there is of equal importance to those items in the manufacture of heading wire. However this doubtless is fully appreciated by our friends in Great Britain who doubtless also have encountered examples of where perfectly good heading stock was ruined in the cold heading operation.

✦ ✦ ✦

IN respect to the thought that the bolt works take the view that they are entitled to expect to receive wire which will yield 100%

good bolts I am afraid that we who produce both the wire and the bolts feel that this is more of an ideal to strive toward than a condition that we could expect to completely realize. I doubt if we can ever expect to reach the point where the finished product will not have to be inspected and in the case of important material like aircraft bolts I am sure that the finished bolt should receive 100% inspection. However, I agree that the bolt manufacturer has every reason to expect to receive product free from deep seams or surface imperfections. If such surface imperfections are removed by billet preparation before the rods are rolled, the surface defects resulting from poor pass design or poor roll adjustment in the finishing mill should be avoided and guarded against by the finishing mill rollers.

✦ ✦ ✦

THE British experience in encountering more tendency for heading difficulties as the size of the bolt increases quite definitely parallels our own experience. In fact in the American Iron & Steel Institute Manual on Wire Rods the following paragraphs appear:

'Wire rods from No. 5 to 15/32 In., inclusive, are generally produced on rod mills by the double or multiple-strand method. Wire rods over 15/32 in. to 47/64 in., inclusive, are commonly produced by the single-strand method and are often referred to as combination rods.

'Aside from the differences in methods of rolling indicated above the manufacture of the larger sizes of rods involves additional precautions in steel making and in the preparation of billets to assure a quality equivalent to that more readily obtained in the smaller sizes of rods. The difficulties and losses giving rise to those precautions are commonly recognized as advancing in degree in the following ranges of sizes:

'No. 5 rod to ¼ in. diameter, inclusive
Over ¼ in. diameter to 11/32 in. diameter, inclusive
Over 11/32 in. diameter to 47/64 in. diameter, inclusive'

✦ ✦ ✦

IT is probable that cold heading will always present problems to the steel manufacturer and to the bolt maker and we know that, as steel makers, we must use every precaution from the open hearth through to the finishing of the wire if we are to avoid excessive rejections. By this I mean that the best melt practice should be followed, the best casting pit and ingot mould practice should be employed, the best ingot soaking pit practice and billet mill practice must be observed, the billets should be very carefully inspected and very carefully prepared as to surface, the rolling of the rods must be critically regarded, and special care must be used throughout the wire mill practice including the annealing, cleaning house, and wire drawing procedure."

✦ ✦ ✦

Answer No. 4

"WE do not make a large quantity of cold heading products at the present time, but our past experience tied in with our current practice on upset forgings has given us a very satisfactory seam free product in the carbon ranges they mention. Of course, our knowledge of English practice is very limited and so many factors can contribute to seams or roakes that we can only give them a few suggestions which we hope will be of some value to them.

✦ ✦ ✦

ROAKES in steel ingots, seams in our practice, can be caused by numerous conditions. I would suggest that they first examine their furnace and deoxidation practice closely. It is essential to get such grades of steel thoroughly deoxidized so that no blowholes exist in the ingot, particularly close to the surface. About one to one and a quarter pounds of aluminum per ton is necessary in addition to the silicon shown.

✦ ✦ ✦

I WOULD then examine the ingot moulds themselves. They should be in good condition and must be at a temperature between 125° F and 400° F to insure a dense, deep chill zone whose fine grained toughness is essential in preventing skin ruptures.

✦ ✦ ✦

THE mold wash should be examined. They should use a mold wash, but it must be carefully controlled. If they use tar or pitch and apply by dipping the molds into a tank, coky residues will be formed by the action of the hot molds. These coky residues will cling to the mold wall and cause many very troublesome seams. This is extremely important. If they use the above practice, fresh tanks using new tar or pitch must be made up frequently.

✦ ✦ ✦

THE contour of the mold wall is also important. If the mold wall is flat, the ingots must be stripped very early after pouring or else tearing will occur in a longitudinal direction which will result in very deep seams.

✦ ✦ ✦

CHARGING temperature into the soaking pits should be as high as possible and thorough heating is absolutely necessary. A rolling temperature of at least 2150° F to 2200° F is essential. Billet should finish over 1850° F.

✦ ✦ ✦

IF this practice is followed, presuming, of course, that good clean heats free from excessive nonmetallic inclusions are made, they should have no trouble with roakes or seams. Mill turn-down and laps are their problem."

✦ ✦ ✦

Answer No. 5

"IT is generally recognized that this type of business offers a lot of difficulties unless it is recognized that extreme care is necessary in all stages of manufacture, from the open hearth to the finished wire. We are, of course, more familiar with the alloy heading wire and the practice is to use approximately 50 per cent pig iron with 50 per cent heavy melting scrap. The heats are melted high, ored down with a minimum amount of ore, blocked in the furnace with silicon and manganese added to the furnace before tapping. The heats are generally made fine grain by the use of aluminum in the ladle plus .15/.30 silicon added in the ladle. The steel is cast in Big End Up molds and extreme care is taken in heating for rolling.

✦ ✦ ✦

THE ingots are double converted — that is, pickled and

chipped twice on the way down to the billet for the final rolling into rods. The rods are then annealed with special attention to decarburization and cold drawn with a comparatively light cold drawn pass.

✦ ✦ ✦

THE cold drawn coils are then checked as follows. Both ends of each 200 lb. coil are pickled to reveal seams and pipe. The samples are then checked for Brinnell hardness. With this practice our shipping yield is in the order of 95 per cent. We have furnished a large amount of alloy cold heading wire and our experience in customers' plants is very good. We do not experience any of the difficulty mentioned in the correspondence.

✦ ✦ ✦

IT should be emphasized that cold heading wire is difficult to manufacture so that the bolt makers will have a minimum amount of trouble."

✦ ✦ ✦

Answer No. 6

"FROM the information contained in the inquiry, it is apparent that the defects are all of a surface nature. Perhaps, the best way to combat surface defects is to surface condition the steel at an intermediate point in the rolling such as any billet size on which it is practical to chip or scarf the steel. In order to do the best job of scarfing, billets should be pickled free of scale so that all surface defects can readily be recognized. If the condition involves a large number of small seams, it would probably be best to skin scarf the billets wherein the entire surface is removed to a depth sufficient to get to the bottom of all seams. If the condition involves only occasional surface breaks, then it would probably be best to spot scarf or chip.

✦ ✦ ✦

WHEN steel is made up into a large number of small units in the finished product, it is usually very costly to inspect these small units and frequently large percentage of scrap results in which a large amount of labor has already been expended. It is, therefore, much more economical to surface condition the steel in the billet form and therefore eliminate all surface defects before the steel gets into the finished product.

✦ ✦ ✦

THIS does not insure the absence of surface defects because laps can occur at subsequent rolling into billets, but it is considered to be a much more satisfactory practice from every standpoint than to roll the steel through without surface conditioning and sort out the final defective bolts."

✦ ✦ ✦

Answer No. 7

"WE do not know whether other firms on this side who have made a success of this grade of wire have to resort to the same process that we have followed for some years past, nevertheless, I think we can claim to have made a success of these grades.

✦ ✦ ✦

OUR practice, which may seem very expensive, is as follows:

✦ ✦ ✦

WE cast the ingots in hot top moulds, the ingot weight being in some cases about 9,000 pounds, and in others about 11,000 pounds. We roll all ingots into a 9 x 10 bloom and cut the bloom into lengths suitable for reheating in a continuous furnace. These blooms are allowed to go cold and are thoroughly chipped to remove seams and other surface defects. They are then re-heated and put through our continuous billet mill into 1-¾" square billets, 30 feet long. Every billet is marked with its ingot number and billet number so that we know the exact location in the ingot of every billet. Owing to our continuous billet mill being of an old type, we found that it was quite possible for decidedly defective billets to be produced even from the thoroughly chipped 9 x 10 blooms. To guard against this, we saw off samples from the top end of every billet and the bottom end of the bottom billet of each ingot, for cold compression testing. These pieces are sawn about 1-¾" long and are squeezed down on the cross section until they are half that length. Billets which show any signs of seams or laps are diverted to other business.

✦ ✦ ✦

EVEN after assuring good quality billets for our rod mill by the above procedure, we have found that only by exercising continual vigilance in the rod mill, that a rod suitable for cold heading could be produced. The rods are rolled into 300 pound coils and after trimming a proper amount from each end, sample pieces about 1 foot long are cut from each coil, the coils being given a serial number on each heat. These sample pieces of rod from both ends of every coil are sent to the laboratory where pieces for cold compression testing are sawn from each and every one. We saw pieces of a length about equal to the diameter and squeeze them down cold on the cross section until the height is reduced to half of the original. These compressed buttons are then carefully examined with a magnifying glass and any showing appreciable signs of checking are noted and the corresponding coils of wire diverted from the shipment.

✦ ✦ ✦

WE may say that when we first went into this business, we found that in spite of supplying excellent billets to the rod mill, a very large proportion of the rolled rods were entirely unsuitable for cold heading. In fact it has been our experience that the bulk of the trouble comes in the final rolling of the rod from the 1-¾" billets. For a long time past our rejection of the rods have averaged not more than about 3", but once in awhile the mill will slip up and perhaps produce defective rods on one section of an order, though all the other sections may be entirely satisfactory. This cold compressing of a sample from both ends of every coil sounds like a lot of work but it can be done, with the proper equipment at a cost of not over $1.00 per ton.

(*Please turn to Page 643*)

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THE Wire Association is a non-profit organization of wire mill executives, superintendents and foremen. It also includes plant engineers, traffic men, and all others engaged in the production of cold drawn bars, rods, wire, strip, insulated wire and cable, and the manufacture and fabrication of finished wire products, including cold headed, extruded and other cold worked metal products.

THERE are separate divisions for all the separate major interests in the wire industry, steel, iron, brass, copper, alloy, and precious metals, together with divisions relating to drawing, cold working, cold heading, extruding, fabricating, forming, spring making, wire cloth, wire rope, bare and covered electric wire and cable and all other forms of wire and wire products.

✦ ✦ ✦

PURPOSES

ITS specific purpose is to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among the members.

✦ ✦ ✦

ACTIVITIES:

The Association functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste.
8. Such other subjects as may be determined upon.

PROGRAM

Wire Association Wartime Emergency Convention

Chicago, Illinois, October 18-22, 1943. Association Headquarters--Hotel LaSalle

The Exposition and Show of the National Metal Congress Will Be Open from Monday to Friday Inclusive, All Day and Every Evening During the Week Except Thursday Evening.

+ + +

Wire Association Headquarters at The Hotel LaSalle Will Be Open From 10:00 A. M. to 11:00 P. M. During the Entire Convention—Come and Get Acquainted!

+ + +

THERE WILL BE A REGISTRATION FEE OF $5.00 FOR THOSE ATTENDING THESE TECHNICAL SESSIONS AND INFORMAL MEETINGS

+ + + ADMISSION WILL BE BY BADGE ONLY + + +

Open Discussions Will Be Held On the Papers Presented and These Discussions Will Be Published in the January, 1944, Issue of Wire and Wire Products

PROGRAM COMMITTEE

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R. E. Brown, Editor and Publisher, WIRE & WIRE PRODUCTS, Stamford, Conn.

SMOKER ACTIVITIES
A. R. Zapp, Manager, Firthaloy Div., Firth-Sterling Steel Co., McKeesport, Penna.

The Technical Sessions End Thursday in Order that Friday May Be Available To Make A Thorough Inspection of the National Metal Exposition at the Palmer House

Hotel reservations may be made by members of The Wire Association direct with the Hotel LaSalle prior to October 10, 1943. *Watch out for this—Make your plans now to attend and send your reservation card in promptly.*

MONDAY, OCTOBER 18

10:30 A. M.
DIRECTORS' MEETING

12 NOON
PROGRAM COMMITTEE LUNCH

Registration and Information. (Mezzanine of Hotel LaSalle) — October 18-22 — in charge of Mrs. R. S. Spengel, Secy.-Treas., WIRE & WIRE PRODUCTS.

— The Technical Sessions —

ALL RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS

The Discussions and the Mordica Memorial Lecture Will Be Printed in the January, 1944 Issue of Wire and Wire Products

MONDAY, OCTOBER 18

Afternoon Session — 2:30 P. M.

	C. A. Litzler, Chief Engineer, Chairman of Meeting	Industrial Oven Engr. Co., Cleveland, Ohio
OPENING ADDRESS	Carl E. Johnson	President of the Wire Association
LECTURE: "Designing Mills for Government Purposes"	Paul M. Mueller, Engineer	Revere Copper & Brass Company Rome, N. Y.

No preprints of this lecture will be available.

LECTURE: "Training in Work Simplification"	Allan H. Mogensen Editorial Staff	"Factory" New York

This is an explanation of work simplification by the use of moving pictures.

TUESDAY, OCTOBER 19

Morning Session — 9:30 A. M.

	R. B. Whyte General Superintendent, Chairman of Meeting	MacWhyte Co., Kenosha, Wis
PAPER: "Drawing High Speed Rope Wire"	John C. Aiken, Assistant Superintendent Rod & Wire Dept.,	Jones & Laughlin Steel Corp., Aliquippa, Pa.
PAPER: "Graphical Solution of Wire Mill Mathematical Problems"	E. J. Crum, Galvanizing Foreman, Rod & Wire Department,	Bethlehem Steel Company Sparrows Point, Md.

TUESDAY, OCTOBER 19

Afternoon Session — 1:30 P. M.

	Fred M. Crapo, President, Chairman of Meeting	Indiana Steel & Wire Co., Muncie, Ind.
PAPER: "The Use of Lead Base Coatings as a Substitute for Zinc"	C. A. Kellogg, Chief, Dept. of Metallurgy and Inspection,	Continental Steel Corp., Kokomo, Indiana
PAPER: "Hydrogen Brittleness in Spring Steels"	Rodman R. Tatnall, Metallurgical Engineer	Wickwire Spencer Steel Company, Worcester, Mass.

WEDNESDAY, OCTOBER 20

Morning Session —10:00 A. M.

Carl E. Johnson, President, The Wire Association, Chairman

THE MORDICA MEMORIAL LECTURE

To Be Presented By
Flint C. Elder,
Special Research Engineer,
American Steel & Wire Co.,
Cleveland, Ohio

TITLE: "THE WIRE DRAWING DIE"

WEDNESDAY, OCTOBER 20
1:00 P. M.

WIRE ASSOCIATION ANNUAL LUNCHEON — HOTEL LaSALLE

— GUEST SPEAKERS —

Sigrud Maseing,
Norwegian Consul,
Chicago, Ill.

and

Captain A. J. Wellings,
Chief of Navy Material Inspection
Navy Dept., Washington, D. C.

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(Members are at liberty to bring guests to hear this interesting speaker. Ladies are welcome and members and guests of other societies participating in the National Metal Congress are also invited to attend.)

At The Organ — Leo Terry

WEDNESDAY, OCTOBER 20
4:00 P. M.

Wire Association Annual Meeting
Carl E. Johnson,
President, The Wire Association
CHAIRMAN OF MEETING

HOTEL LaSALLE

WEDNESDAY, OCTOBER 20
Evening — 7:30 P. M.

ANNUAL DINNER — STAG SMOKER — HOTEL LaSALLE

A. R. ZAPP,
Manager, Firthaloy Division,
Firth-Sterling Steel Company
McKeesport, Pa.
CHAIRMAN OF COMMITTEE

THURSDAY, OCTOBER 21
Morning Session — 9:45 A. M.

	Glenn E. Rolston Chief Engineer Chairman of Meeting	Rome Cable Corporation Rome, N. Y.
PAPER: "Fiberglas As An Electrical Insulation"	L. T. Russell, Electrical Engineer	Owens-Corning Fiberglas Corp., Newark, Ohio
PAPER: "A Discussion of Electrical Tapes for Wire Insulation"	Paul W. Kollar	The Dobeckmun Co. Cleveland, Ohio

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THURSDAY, OCTOBER 21
Afternoon Session — 1:30 P. M.

	Benjamin H. Davis, Engineer, Chairman of Meeting	John Royle & Sons, Paterson, N. J.
PAPER: "Properties and Uses of Vinyl Resins for Wire & Cable"	G. A. Fowles Plastic Materials Division	B. F. Goodrich Company Akron, Ohio
PAPER: "Extrusion of Vinyl Compounds in the Wire and Cable Industry"	H. K. Intemann	Halowax Products Div. Union Carbide & Carbon Corp. New York, N. Y.
Motion Picture	"Rubber in Industry"	B. F. Goodrich Company Akron, Ohio

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THURSDAY EVENING
OCTOBER 21 — 7:00 P. M.

AMERICAN SOCIETY FOR METALS DINNER
(Tickets for this dinner may be obtained at The Wire Association Registration Desk)

THE WIRE ASSOCIATION MEDAL AWARDS

For the Most Meritorious Paper on Wire Manufacture or Fabrication During the Year.

MEDAL AWARDS

1934 — EDWARD J. P. FISHER
Metallurgist, Keystone Steel & Wire Co., Peoria, Ill.
Title of Paper: "COLD DRAWN STEEL SPRING WIRE"

1935 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper: "GRAIN SIZE AND ITS INFLUENCE ON THE MANUFACTURE OF STEEL WIRE"

1936 — ROBERT NOTVEST
Chief Engineer, Welding Division, J. D. Adams Mfg. Co., Indianapolis, Indiana
Title of Paper:
"STEEL FOR ARC WELDING ELECTRODES"

1937 — BENJAMIN LEWIS McCARTHY
Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N.Y.
Title of Paper:
"ABNORMAL GRAIN GROWTH AND THE ANNEALING OF LOW CARBON STEEL WIRE"

1938 — WALTER R. BLOXDORF
Metallurgist, The MacWhyte Co., Kenosha, Wis.
Title of Paper: "WIRE ROPE"

1939 — STANLEY P. WATKINS
Manager, Sales Development, Rustless Iron and Steel Corp., Baltimore, Maryland
Title of Paper:
"THE MANUFACTURE AND USE OF STAINLESS STEEL WIRE"

1940 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Company, Atlanta, Georgia
Title of Paper:
"GALVANIZING CHARACTERISTICS OF DIFFERENT TYPES OF STEEL"

1941 — CARLETON W. GARRETT
Wire Mill Metallurgist, Jones & Laughlin Steel Corp. Aliquippa, Pennsylvania
Title of Paper:
"A BRIEF DISCUSSION ON THE MANUFACTURE OF STEEL FOR ARC WELDING ELECTRODES"

1942 — LEROY DEVOE SEYMOUR
Asst. Works Manager, Canada Works, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada
Title of Paper:
"SCHEDULING AND PLANNING THE WIRE MILL FOR WAR PRODUCTION"

HONORABLE MENTIONS

1935 — L. D. SEYMOUR
Metallurgist, Rod and Wire Dept., Youngstown Sheet & Tube Co., Youngstown, Ohio
Title of Paper: "COLD HEADING WIRE"

1935 — R. A. SCHATZEL
Superintendent, General Research Laboratories, General Cable Corp., Rome, N. Y.
Title of Paper: "HARD AND SOFT COPPER WIRE"

1936 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper:
"PLASTIC DEFORMATION IN WIRE DRAWING"

1937 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Co., Atlanta, Ga.
Title of Paper:
"A METALLURGICAL STUDY OF THE FACTORS AFFECTING THE QUALITY OF GALVANIZING"

1937 — ALLAN B. DOVE
Chemical Engineer, Canada Works, The Steel Company of Canada, Ltd., Hamilton, Ont., Canada.
Title of Paper:
"A. C. ELECTRO PICKLING—A BETTER METHOD OF PICKLING"

1938 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper: "RESILIENCE OF SPRINGS"

1938 — JOSEPH A. DOYLE
Vice President, W. S. Rockwell Co., New York, N. Y.
Title of Paper: "HEATING COPPER WIRE BARS"

1940 — H. BLOUNT and J. D. WILTRAKIS
Mfg. Engineer, Point Breeze Works, Engineer, Kearny Works, Western Electric Company
Title of Paper:
"DESIGN AND OPERATION OF A NEW COPPER WIRE DRAWING PLANT"

1941 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper:
"TIME, TEMPERATURE AND SIZE IN THE HEATING OF STEEL WIRE"

1942 — COLONEL FRANK W. BULLOCK
Signal Corps, United States Army
Title of Paper: "THE WIRE INDUSTRY IN WAR"

ANNUAL MEDAL AWARD OF THE WIRE ASSOCIATION

FOR THE MOST MERITORIOUS PAPER ON WIRE MANUFACTURE OR FABRICATION DURING THE YEAR
— BY A MEMBER OF THE WIRE ASSOCIATION —

ALL members of the Wire Association are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

✦ ✦ ✦

AN annual medal will be awarded in each of the two major divisions of the activities of the Association, to the papers coming nearest to the requirement set forth above.

✦ ✦ ✦

CONSIDERATION for the Medal Awards is not limited to the papers presented at the Annual Meeting, but is given to all papers submitted by members and published in "WIRE & WIRE PRODUCTS" during the year.

✦ ✦ ✦

ADDITIONAL information may be obtained by addressing:

✦ ✦ ✦

SELECTION of papers to be presented at the Annual Convention rests in the hands of the Joint Program Committee and the Board of Directors of the Wire Association.

✦ ✦ ✦

ALL papers submitted become the property of the Wire Association and the Board of Directors constitutes the Committee on Awards.

✦ ✦ ✦

RICHARD E. BROWN, SECRETARY, THE WIRE ASSOCIATION

300 MAIN STREET — STAMFORD, CONNECTICUT

High Tensile Bolt Production

(*Continued from Page 634*)

YOUR old country member enquires as to the effect of intermediate heat treatment of the rods or wire. We think this merely makes the wire easier on the cold header dies. We would not expect it to cause wire to crack that was sound before heat treatment nor would we expect it to prevent checking on wire which was defective before treatment, although it might lessen the degree of trouble to some extent. Of course it is highly desirable to have the ingots roll with a minimum of cracking and the chief factor in accomplishing this is a slow rate of pouring of the liquid steel into the mould.

✦ ✦ ✦

I AM of the opinion that we can get along without the necessity of chipping between the ingot and the 1-¾" billet, if the rolling of the ingot was watched and any observed unsuitable steel, diverted. We adopted the chipping of the 9 x 10 blooms largely to offset any alibi that the rod mill may have, by claiming that they were getting defective billets. As already stated, the bulk of the trouble originates in the rod mill itself from laps and such like rolling defects and before we could convince the mill of this, we had to supply them with admittedly perfect billets and we have kept up the practice ever since, as above described."

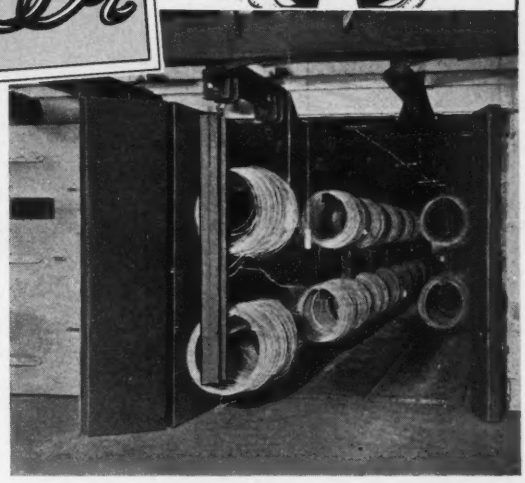
✦ ✦ ✦

Answer No. 8

"IN replying to this question, I do not believe that it should be necessary to test each and every bolt for any and all types of construction. Bolts used in the construction of vehicles and tanks should not require any inspection after forming. Aircraft bolts should be tested in amounts not exceeding 10% of any one shipment. This is due to the severe type of inspection that the present aircraft specifications impose on the manufacturer. If one quarter of the bolts of the 10% tested should fail on account of seams,

(*Please turn to Page 644*)

It's the new ROSS Wire Baker



..that shortens the baking cycle

A modern "must" for Wire and Rod Mills that need increased production and improved quality of product. The Ross Baker circulates high temperature air, clean and free from all products of combustion, to greatly speed up drying. Troublesome rusting and irregular lime coating are eliminated—quality is improved. Air Heaters use any oil or gas fuel available.

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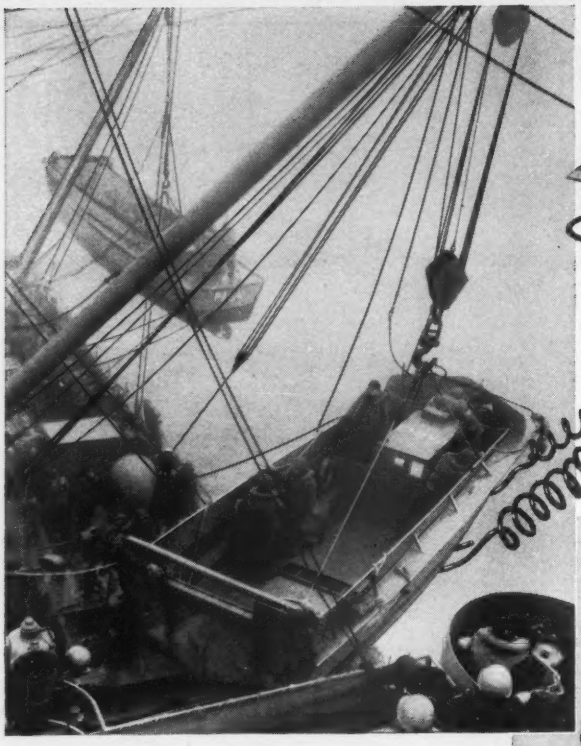

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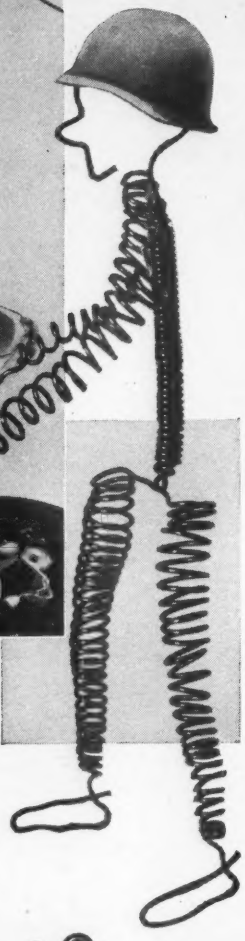
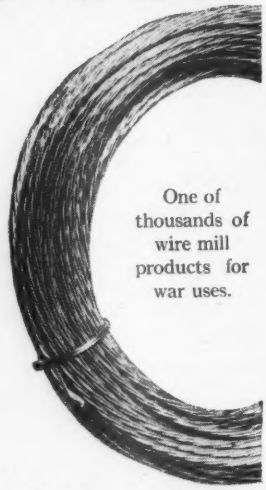


Lending a Hand for Invasion . . . ..KEYSTONE wire

This scene—launching landing barges for the attack on Attu—is now being re-enacted time after time at many invasion hot spots. And every time it occurs, wire is privileged to play a highly essential role. Notice the hundreds of feet of husky cable required for each boom that swings a barge over the side of the transport.

This is but one of thousands of ways in which wire mill production helps add impetus to the invasion. Planes, bombs, ships, tanks and ammunition, too, call on Keystone for many vital parts.

Victory comes first . . . after that we hope to again lend an efficient hand on many CIVILIAN assembly lines.



One of thousands of wire mill products for war uses.

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Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Just a little SCRAP counts up for finishing the big scrap!

High Tensile Bolt Production

(*Continued from Page 643*)

then the particular lot should be tested 100%.

✦ ✦ ✦

IF our British friend insisted that the tests for seams be applied to the hot rolled rods and then to the wire at the source of manufacture, and again at the cold heading operation, there should be no reason to apply any extensive test for seams in the finished bolts.

✦ ✦ ✦

THERE are many tests for seams that can be applied to the hot rolled rods and the cold drawn wire. The preferable one is a torsion test in a 3″ length applied to each end of the coils of hot rolled rods then to the coils of cold drawn wire. Due to the peculiarities of the present method of hot rolling small rounds, the worst seams are found on the ends of the coils. If the ends of the coil withstand a torsion test for seams, there will be no trouble with the remainder of the coil when cold headed into bolts.

✦ ✦ ✦

THE preferable way to make the torsion test for seams consists in bending the specimen of rods or wire 90° in the same direction at a space 3″ apart. The "U" shaped sample should then be fitted into clamps and rotated 360° in one direction and then 360° back into its original shape. This twisting of the 3″ length in a clockwise direction and then immediately in a counter-clockwise direction will open up any seams that will prove detrimental in a cold heading operation. The insistence of bolt makers that their stock be free from harmful seams is a justifiable demand at the present time."

✦ ✦ ✦

Answer No. 9

"I WAS very much interested in the British member's comments on his troubles in using cold heading wire of the two grades mentioned. These grades are practically identical with two of the most important high-tensile grades

(*Please turn to Page 648*)

Extrusion of Vinyl Compounds in the Wire and Cable Industry

(*Continued from Page 623*)

with temperature controllers on each system, for the different sections of the machine.

+ + +

THE materials are usually supplied in granular or strip form. The strips are put in roll form for ease of handling. The materials are fed at room temperature to small diameter worm extruders for insulating small diameter wire. For most purposes, the maximum efficiency, when cold feeding a tuber having approximately a 3-¼-inch worm, is reached when extruding a heavy wall of 3/64-inch on a construction having an outside diameter over the insulation of .222 inch, such as an AWG #8 SN type. This is based on the particular grade of vinyl resin used and a 65 to 85 pounds per hour capacity for the machine when using this grade.

WHEN extruding larger sizes, it is often necessary to preheat the compound on a two-roll mill in order to increase the tubing capacity and increase the wire speed. This increase is in the neighborhood of 200 to 300 per cent for the larger size wires. However, for the smaller size wires there appears to be very little advantage or gain by using a mill. When insulating larger size wires, or jacketing cables ranging from .5 inch to 5 inches in outside diameter, a plastics extruder having approximately a 6-inch diameter worm is generally used. The large machines are similar to the smaller type in that the capacity can be increased 200 to 300 per cent by preheating on a mill the stock to be extruded.

+ + +

IN order to obtain maximum extrusion speeds along with a minimum number of spark failures, it is desirable that a temperature gradient be maintained throughout the machine along with the proper worm speed to give satisfactory delivery of the compound and proper head pressures. The temperature gradient and worm speed vary for different amounts of compound being extruded.

+ + +

FIGURE 2 illustrates a typical correlation of screen set-up, worm speed and temperature in the head, die and collar sections for plastic tuber having a worm diameter of 3-¼ inches and 28-½ inches long. For example, an AWG #22 solid wire with a 1/64-inch wall of insulation, which repre-

(*Please turn to Page 646*)

This is an invitation for you to become a member of The Wire Association. + + + + + +

The Annual Dues are $10.00

+ + +

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Extrusion of Vinyl Compounds in the Wire and Cable Industry

(*Continued from Page 645*)

sents approximately 24 cubic inches of compound per 1,000 feet is extruded at elevated temperatures and at a low worm speed. An AWG #8 solid wire with a 3/64-inch wall of insulation represents about 312 cubic inches of compound per thousand feet. In order to maintain the head pressure and extrusion rate with the larger die opening and to maintain sufficient frictional working of the compound, lower temperatures are used along with higher worm speeds. With higher worm speeds it is very important to have sufficient cooling water passing through the core of the worm to eliminate any possibility of thermal breakdown of the compound. With each set of conditions, the proper amount of cooling water should be introduced in the core of the worm to give the proper plastic flow of the compound. A temperature indicating device should be a part of standard equipment in order to definitely control the temperature of the water-exit temperature.

✦ ✦ ✦

THE barrel extension should be set approximately 30 degrees and the feed section 60 degrees Fahrenheit lower than the values shown. It also holds true that the capacity of the machine can be increased for a given wire size by increasing the worm speed and by decreasing the tuber temperatures. However, too great an increase in wire speed results in an increased number of spark failures.

✦ ✦ ✦

FIGURE 3 illustrates the effect of worm speed under set temperature conditions on the capacity of the extrusion machine and is helpful in evaluating tubing efficiency of various compounds and determining the proper worm speed for a given job.

✦ ✦ ✦

WHEN using plastic extruders, without breaker plates, or screens, which have a worm diameter of about 3-¼ inches, and a length of about 39 inches, including a 4-inch cone on the end of the worm, high temperatures in the head, die and barrel are generally used along with high worm speeds (30 to 60 r.p.m.) for most sizes of insulated wire in order to create the proper plastic flow.

✦ ✦ ✦

WHEN using a two-roll mill to preheat compounds for plastic tubers or converted rubber tubers, lower temperature conditions in the extruders are generally maintained than when feeding materials which are at room temperature.

✦ ✦ ✦

IT is general practice for the mill operator to place the rolls of vinyl resin tape, as supplied, on a mandrel near the mill, and allow the mill to draw the tape in automatically. Because the tape is thin, it picks up more readily on the mill than do heavier sections. With

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TO SAVE ACID AND METAL. TO PREVENT OVER PICKLING AND BURNING ROD & WIRE.

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granular material a hopper feed is generally used.

✦ ✦ ✦

THE thickness of blanket or sheet being milled should be about ¼ to ½ inch and a small bank should be employed. When cutting strips from thinner blankets for feeding the extruder, the strips chill too readily and result in rough lumps in the insulated wire or cable. In order to insure a smooth sheet on the mill at all times, and in order to keep a sufficient amount of compound on the mill, with the rate at which the compound is being extruded, it is often necessary to have another mill to pretreat the compound. This insures that only thoroughly worked compound is fed to the second mill.

✦ ✦ ✦

WHEN milling stiffer compounds of the vinyl type, caution must be exercised so as not to impart too great a thermal shock on long time milling. At the secondary bank excessive temperatures may result, if care is not taken. In order to relieve this condition the blanket being warmed up can be periodically cut from the mill to reduce the stock temperature. When one mill is used for the complete preworking of the stock, the above can be readily accomplished by the use of a separator placed approximately one-half from one end of the mill. This then leaves one-half of the mill for thoroughly worked compound for feeding to the tuber and one-half for the preliminary treatment.

✦ ✦ ✦

Die Design and Construction

IN the design of dies it is necessary to bear in mind that, because of the elastic nature of the vinyl resin compound, an expansion of about 25 per cent, depending on the die length and shape, will occur immediately as the stock leaves the die. This expansion is compensated for — and size control benefited — by a controlled stretching of the product as the compound leaves the die. For this reason, as well as naturally variable extrusion rates, it is preferable to use a variable speed drive on the capstan. Stretching also effects some slight improvement in surface finish.

✦ ✦ ✦

Die Length

FIGURE 4 illustrates bearing lengths of forming die and its relation to the diameter of the die for sizes up to ½" in diameter.

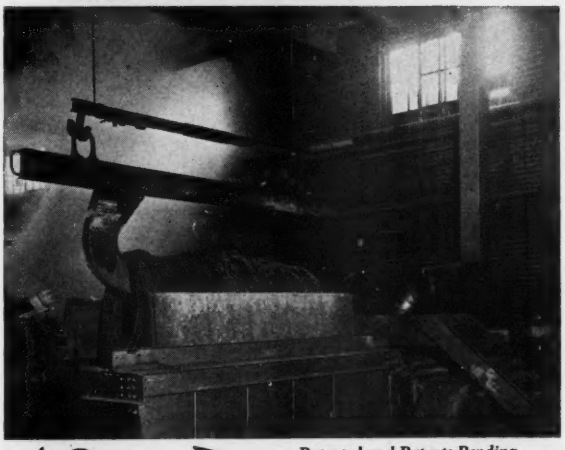
IN general, the bearing length or parallel of the forming die is the same length as the diameter of the die for sizes up to ½ inch in diameter. For sizes larger than one-half of an inch the bearing length is often kept constant at one-half of an inch for all sizes.

✦ ✦ ✦

THE die diameters are usually made 3 to 5 per cent over that of the average outside diameter

(*Please turn to Page 648*)

Can You afford TO PASS UP THIS 50% Saving IN TIME AND FUEL?



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Extrusion of Vinyl Compounds in the Wire and Cable Industry

(*Continued from Page 647*)

being extruded. The necking down, or stretching of the compound at the die, improves the finish of the insulated wire or cable.

✦ ✦ ✦

Summary

IN general the various pieces of equipment necessary for the extrusion of vinyl compounds have been reviewed and certain operating conditions have been outlined. It is well to realize that these conditions may not be the optimum conditions for many types of equipment or sizes of wire, but as the art of extrusion is necessarily a result of experience, it is felt that the conditions are such as to start as a base point for production experience. It should again be pointed out that there is still considerable work to be done in this field; first in the development of improved vinyl extrusion compounds, and second in the development of the equipment used in extruding these compounds. Much of the work to date along these lines has been limited by the necessity of using all available equipment to produce finished products, and it is a sincere hope that all cable manufacturers will, as soon as possible, review the basic fundamentals of extruding these compounds, for it is certain that considerable improvement can be made particularly in the designs of worms, tubing heads, and dies. When peacetime returns the efficiency of the extrusion operation will be a big factor in the competitive use of these materials.

✦ ✦ ✦

High Tensile Bolt Production

(*Continued from Page 644*)

used in American bolt and screw production.

✦ ✦ ✦

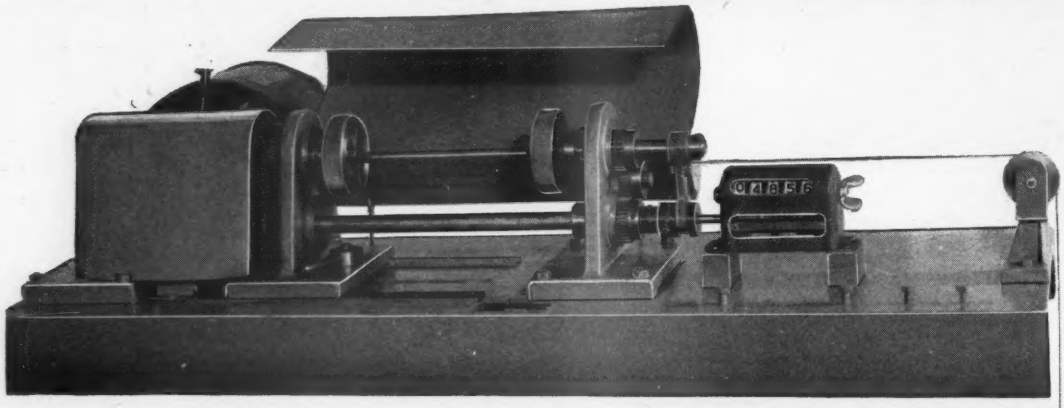
SURFACE defects contributing to split heads are, in our opinion, primarily the result of rolling defects. The importance of such defects in causing split heads in bolts, of course, depends on the type of head to be produced. When we know that the wire is to be used for a bolt head requiring an excessive amount of upset, particularly where one of the higher carbon grades of steel is specified, it is necessary to give special attention, not only to steel-making and teeming practice, but also to special rolling conditions and surface inspection. Naturally such special precautionary measures increase the production cost markedly, and consequently a special quality extra is charged for such wire.

✦ ✦ ✦

THE questions listed by our British member are very pertinent, and we are herewith attempting to furnish answers in the light of our past experience.

✦ ✦ ✦

NO. 1—As far as we have been able to observe, the producer of cold-heading wire can generally



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Newest addition to the group of *Scott Testers serving the wire industry throughout the world is the Twist Tester. Built to take samples from 2" to 8" long, it applies tension from ½ lb. to 17 lbs. twisting from both ends simultaneously. Write us for further information.

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expect trouble when the wire is furnished for the more severe heading jobs. This, of course, is particularly true with the high-carbon or alloy grades. Principal causes for cracking are surface seams and laps. The more critical the upset in cold-heading, the more effective will a minor surface defect be in causing splitting in the upsetting operation.

✦ ✦ ✦

NO. 2—We have had no experience in the manufacture of bolts, hence would not care to attempt an answer to this question.

✦ ✦ ✦

NO. 3—The questionnaire refers to 100% sound wire. We presume he refers to performance in the cold-heading operation. We believe any shipment of wire may contain some surface defects such as light seams, etc., which would not necessarily show up as harmful defects except where the material is subjected to extreme degrees of cold upset.

NO. 4—Various heat-treatments are often applied in the manufacture of wire for cold-heading, depending on size and grade. Here again the degree of upset should also determine the type of heat-treating. For extreme softness and plastic properties it is the general rule to spheroidize in process. The finishing draft is usually as light as possible and yet obtain a surface conducive to practical cold-heading results. Annealing, normalizing or even patenting treatments have also been applied depending on the type of cold-heading and steel grade involved. Some slight moderation in the harmful effect of seams has been effected by allowing a fair degree of scaling to take place in either the normalizing or annealing treatment."

✦ ✦ ✦

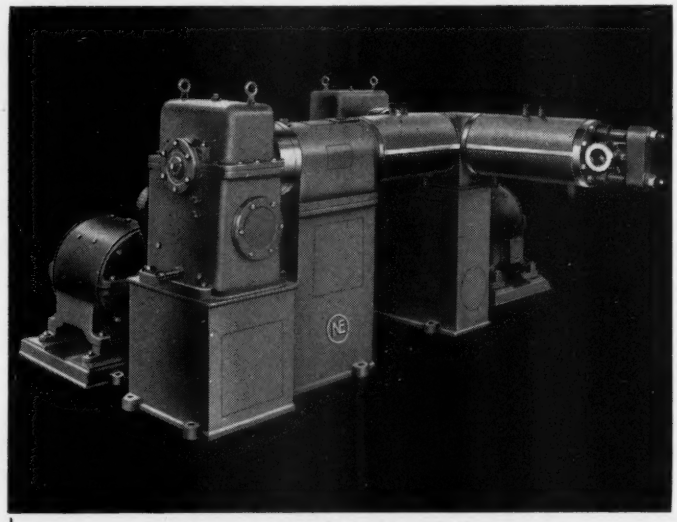
Answer No. 10

"OUR British associate practically answers all the questions that he has raised when he states "in the main, the defects arise from roaky (seamy) ingots, with occasional lapping in the billet or rod rolling." It must be obvious that, any section of steel subjected to cold upsetting, as in the case of bolts, must be free of seams, lapping or other surface defects. If the bolts are to be used in a highly stressed unit, the material must be sound as far as cleanliness or porosity is concerned.

✦ ✦ ✦

DURING the past ten years a great volume of research has been conducted in an effort to simplify the commercial application of melting control. **Dr. C. J. Herty, Jr.**, now with the Bethlehem Steel Corporation, Bethlehem, Penna., initiated a program and developed a large amount of data during his association with the Bureau of Metallurgical Research, Carnegie Institute of Technology, Pittsburgh, Penna. Practically all of the leading steel makers of the United States followed this work with re-

(*Please turn to Page 659*)



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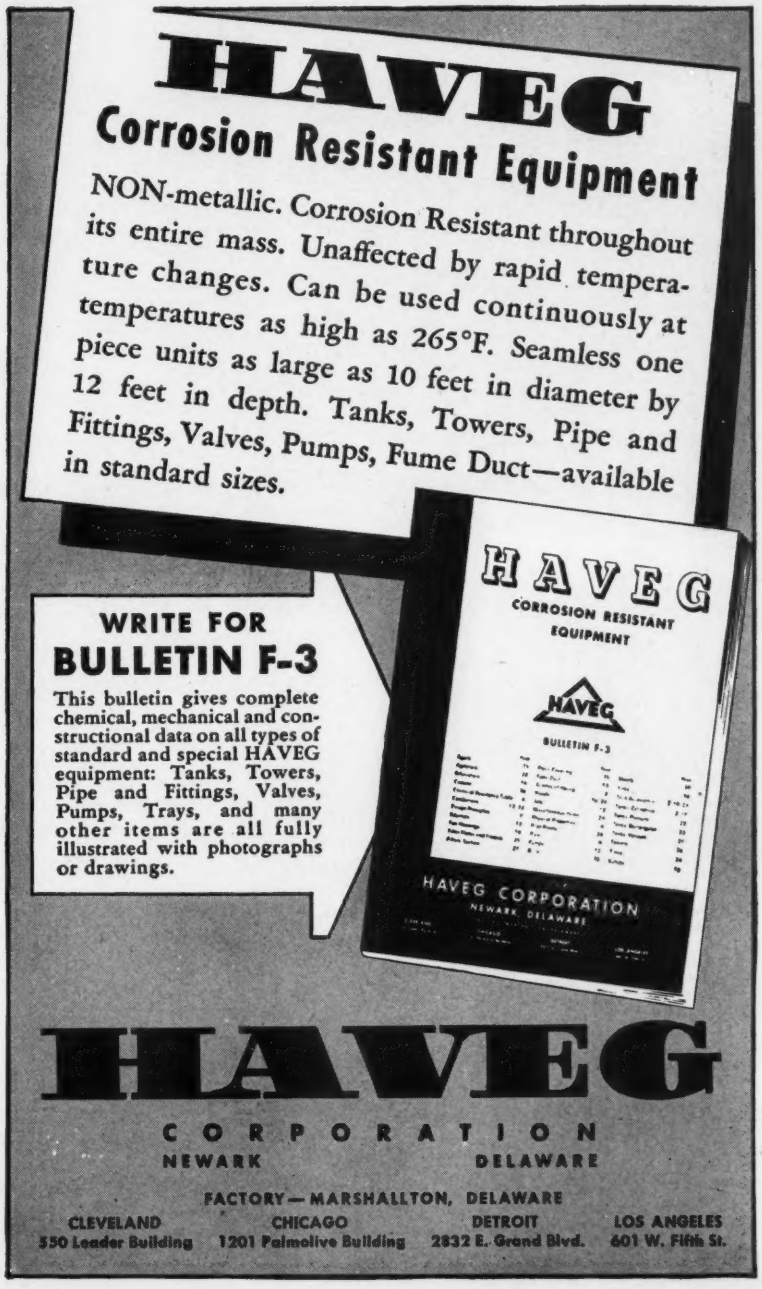
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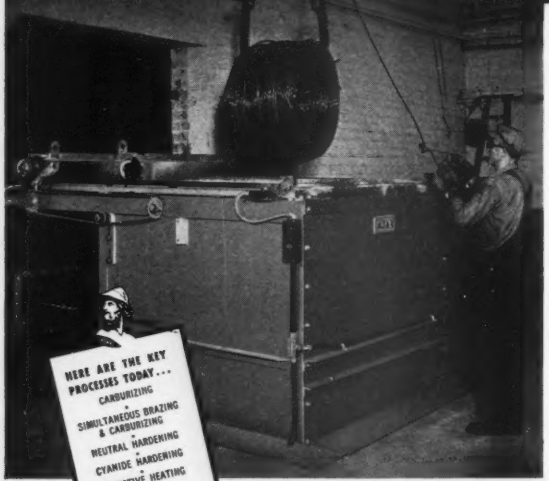

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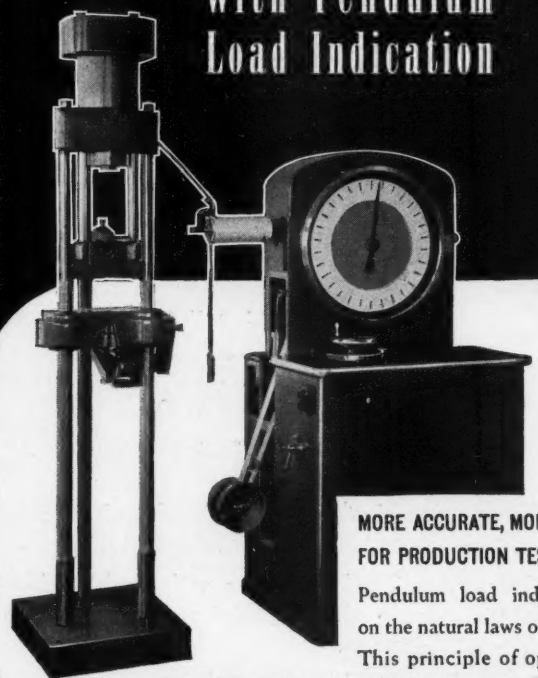

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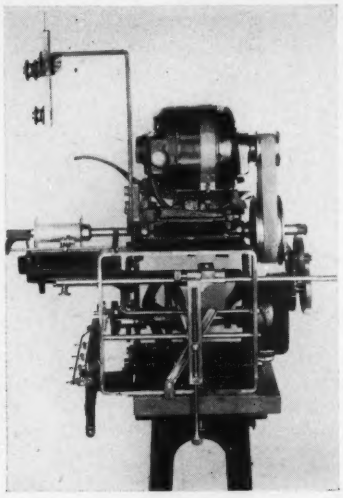

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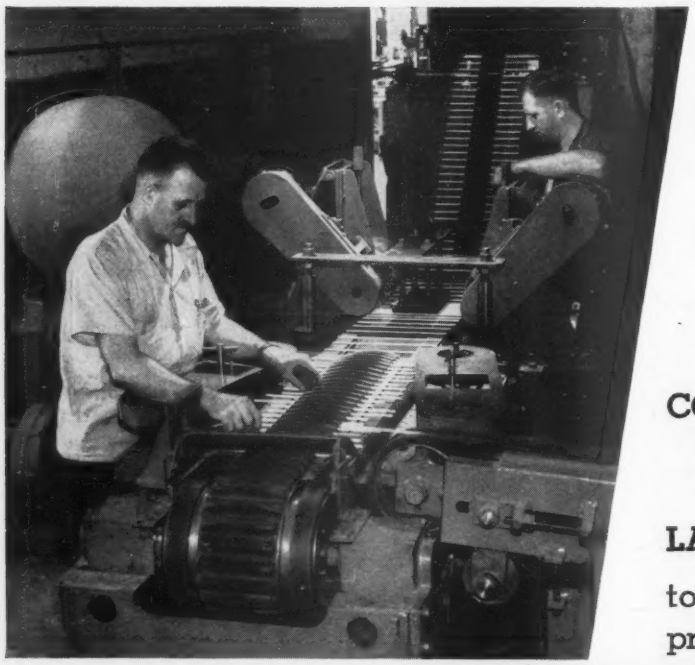

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TIMBERLAKE, J. E., Mgr. Wire Sales,
Jones & Laughlin Steel Corp.,
Pittsburgh, Penna.

TIMMERMAN, E. D.,
Steel Co. of Canada, Ltd.,
Montreal, P.Q., Canada

TREMBICKI, HAROLD L., Wire Mill Repr.,
Magnus Chemical Company,
Cleveland, Ohio

TROSS, E. E., Wks. Mgr.,
Columbus Bolt Works,
Columbus, Ohio

TWIBLE, W. J., Gen. Mgr.,
Graham Nail & Wire Products Ltd.,
Toronto, Ont., Canada

ULLMANN, LEO, Managing Dir.,
Chiswell Wire Co., Ltd.,
London, N.W. 11, England

ULLRICH, FREDK. GEO., Gen. Mgr.,
N. Z. Fence & Gate Works,
Petone, New Zealand

ULLRICH, HENRY F., Asst. Supt.,
John A. Roebling's Sons Co.,
Trenton, New Jersey

UNITED WIRE WORKS, LTD.,
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VanHOOK, CHARLES F., Mgr.,
Cable & Machinery Div. & Ch. Engr.,
Watson Machine Company,
Paterson, New Jersey

vanSTRATEN, J. C., Secy.,
Anton Smit & Co., Inc.,
New York, N. Y.

VanVALKENBERG, F. S., Engr.,
Chg. Wire Drawing Mach. Div.,
Waterbury Farrel Fdry. & Mach. Co.,
Waterbury, 86, Conn.

VAUGHN, L. A., President,
Vaughn Machinery Company,
Cuyahoga Falls, Ohio

VERSCHLEISER, J. H., Sales Mgr.,
Wire Products,
Laclede Steel Company,
St. Louis, Missouri

VIRDEN, C. L., Supt.,
Reid-Avery Company,
Dundalk, Baltimore, Maryland

VOIGTLANDER, CURTIS, Supt.,
Wire Mills,
Union Wire Rope Co.,
Kansas City, Missouri

WAARICH, O. W., Gen. Supt.,
Pheoll Manufacturing Company,
Chicago, Illinois

WAGNER, R. J., Met.,
Central Screw Company,
Chicago, Illinois

WARBRICK, JAMES H., Sales Engr.,
James Day (Machinery) Ltd.,
London, W. 1, England

WARD, C. T., Supt. Rod & Wire Mills,
Bethlehem Steel Company,
Johnstown, Penna.

WARNER, CHARLES M., Supt. Wire Mill,
Scovill Manufacturing Co.,
Waterbury, Conn.

WATKINS, STANLEY P., Mgr. Sales Devel.,
Rustless Iron & Steel Corp.,
Baltimore, 13, Md.

WEBB, E. H., President,
Webb Wire Works,
New Brunswick, New Jersey

WEIKEL, G. A., Sales Engr.,
American Chemical Paint Co.,
Ambler, Penna.

WEILL-QUILLARDET, LEON, Consultant,
Jersey Steel & Wire Corp.,
New York, N. Y.

WEINMANN, E. R., Sales Mgr.,
Nukem Products Corporation,
New York, N. Y.

WELLINGS, CAPTAIN A. J., U.S.N.,
Alexandria, Virginia

WELSH, J. ALAN,
Upper Darby, Penna.

WERME, M. G., Plant Supt.,
Wickwire Spencer Steel Co.,
Clinton, Mass.

WERY, ALBERT G., Devl. Engr.,
General Cable Corporation,
Perth Amboy, New Jersey

WESSEL, E., Vice President,
Beall Tool Company,
East Alton, Illinois

WESTPHAL, LT. COMMANDER, F. A., U.S.N.R.,
c/o Inspector of Naval Materiel,
Houston, Texas

WHEELER, G. CHAS., V. P. & Wks. Mgr.,
Callite Tungsten Corp.,
Union City, New Jersey

WHITBECK, ROLAND A., Secy.-Treas.,
Gilron Products Co.,
Cleveland, Ohio

WHITNEY, LESLIE C., Ch. Met.,
Copperweld Steel Company,
Glassport, Penna.

WHITTEN, J. L., Sales Mgr.,
Lee Wilson Engineering Co.,
Cleveland, Ohio

WHYTE, R. B., Gen. Supt.,
Macwhyte Company,
Kenosha, Wisconsin

WICKWIRE, CHESTER, F., Vice Pres.,
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Cortland, New York
Wickwire Spencer Steel Co.,
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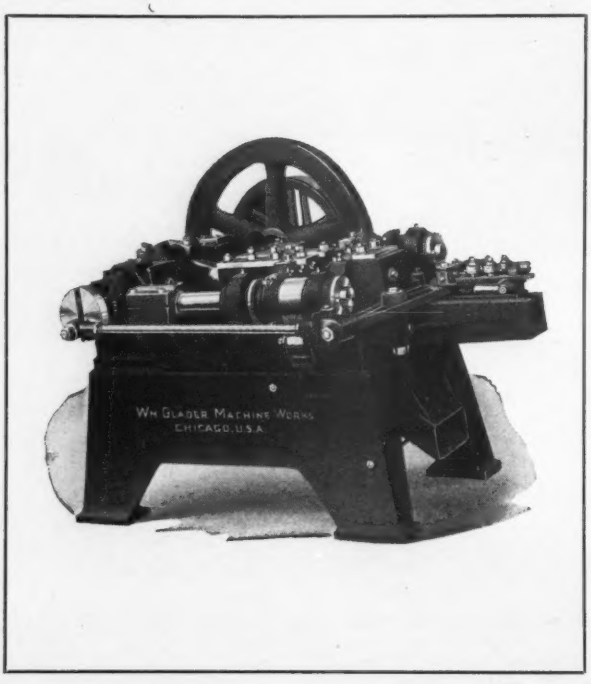

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Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

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WILKIN, ROBERT C., Pacific Coast Mgr., Phelps Dodge Copper Products Corp., Los Angeles, Calif.

WILLIAMS, ROBERT C., Ch. Chemist, The Ironsides Company, Columbus, Ohio

WILSON, FRANK B., Gen. Wks. Mgr., Guest, Keen & Nettlefolds, Ltd., Atlas Works, Darlaston, So. Staffs., England

WILTRAKIS, JOS. E., Sub. Div. Chief, 9901-B, Western Electric Company, Kearny, New Jersey

WIND, WILLIAM J., Secy., Wilbur B. Driver Company, Newark, 4, New Jersey

WINKLER, L. H., Met. Engr., Bethlehem Steel Company, Bethlehem, Penna.

WINSLOW, ALBERT E., Ch. Designer, The Atwood Machine Company, Stonington, Conn.

WINTERSOHL, A. H., Supt., Firthaloy Div., Firth-Sterling Steel Co., McKeesport, Penna.

WIRE INDUSTRIES, LTD., THE, Benares, India

WOOD, MAURICE L., Chase Brass & Copper Co., Inc., Waterbury, Conn.

WOODFORD, F. M., Western Mgr., Tungsten Elec. Corporation, Cleveland, Ohio

WOODHEAD, R. R., Res. Engr., John A. Manning Paper Co., Inc., Troy, New York

WOOLDRIDGE, J., Johnson & Phillips Ltd., Victoria Works, Charlton, London S.E. 7, England

WRIGHT, ALBERT, Owner, Albert Wright, Oakland, California

YOUNG, LAFE, Gen. Supt., Laclede Steel Company, Alton, Illinois

ZAPP, A. R., Mgr., Firthaloy Div., Firth-Sterling Steel Co., McKeesport, Penna.

ZARAFU, HERMAN, Plant Engr., Circle Wire & Cable Co., Maspeth, L. I., New York

ZUR, JOHN P., Met. Engr., Trauwood Engineering Co., Cleveland, Ohio

✦ ✦ ✦

High Tensile Bolt Production

(*Continued from Page 649*)

search programs, and as a result, have been able to improve the quality of their product. The physical chemistry of steel making has been brought to the melting floors of the industry. This has made possible the accurate control of grain size and other important characteristics of steel. Along with this work has come study and better design of ingot molds. The development of a high temperature molten bath thermocouple by **Dr. Fitterer** of the Uinversity of Pittsburgh, was a contribution toward the important variable of temperature control.

✦ ✦ ✦

AN attempt will be made to answer categorically, the questions raised in the questionnaire submitted by our British associate.

✦ ✦ ✦

No. 1. Repeated difficulty with wire is not experienced in this country. If an occasional lot of poor quality wire is encountered it is quickly passed back to the steel maker.

✦ ✦ ✦

No. 2. Common bolts, such as is used for vehicles, etc., do not receive a 100% inspection. Practically all aircraft engine bolts and other bolts used in highly stressed units are subject to the Magnaflux test, which is a 100% inspection. A large volume of these bolts are made on screw machines and they are also subjected to a 100% inspection, primarily because of the requirement of a practically perfect finish.

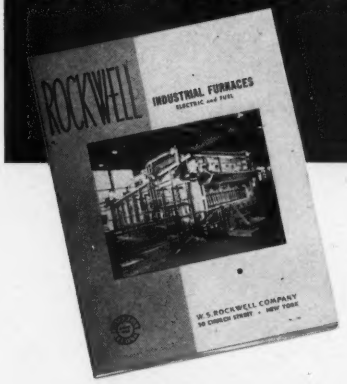
✦ ✦ ✦

No. 3. It is our opinion that the melting and casting practice

(*Please turn to Page 674*)

A PICTURE BOOK OF FURNACES

that every heating equipment user should have

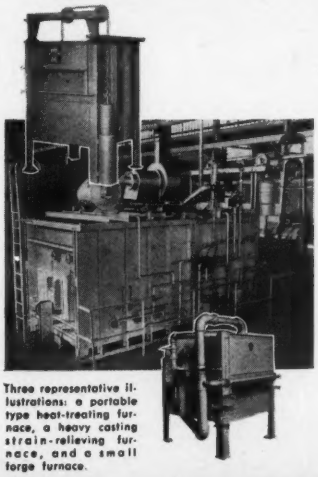


This bulletin is a pictorial index of industrial furnaces . . . every page crowded with illustrations of modern, highly efficient equipment for hardening, annealing, tempering, forging, carburizing, strain-relieving and other heat-treating operations.

More than 125 illustrations of different furnaces

These furnaces range from handy portable types, with applications in many plants, to huge highly specialized units with capacities of many tons per day. The variety of capacities, processes, controls, fuels, arrangements, and accessories which are illustrated practically cover the industrial heating field.

The designs are based on 55 years of specialized experience in building furnaces for every industrial requirement, and provide material well worth studying by every furnace user.



Three representative illustrations: a portable type heat-treating furnace, a heavy casting strain-relieving furnace, and a small forge furnace.

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Outstanding Personalities of the Wire Industry

W. F. Knoll, Acting General Manager Trenton N. S. Steel Works, Ltd., and the Eastern Car Company, New Glasgow, N. S.

THE many friends in the Wire Association of **"Bill" Knoll** will be interested to learn of his appointment as acting general manager of the Trenton N. S. Steel Works Ltd., and the Eastern Car Company of New Glasgow, Nova Scotia.

✦ ✦ ✦

MR. KNOLL was born in Milwaukee, Wisconsin and started work in that city with the Allis Chalmers Company, later going with the Wisconsin Engine Company of Corliss, Wisconsin and from there to the Republic Iron and Steel Company at Youngstown, Ohio. From this latter company he went to the Dominion Iron and Steel Company at Sydney, N. S. He was later transferred to James Pender & Company at Saint John, N. B., a subsidiary of the Dominion Company.

WILLIAM F. KNOLL

FOR the past two years Mr. Knoll, former general manager of James Pender & Co., Ltd., had been on loan to the Federal Steel Controller's Office as Deputy Controller of Wire, Nail and Rod Products, which position he resigned in August.

✦ ✦ ✦

APPOINTMENT of Mr. Knoll to this important industrial position follows with consistency his career in his field of endeavor. Among the positions he has held have been manager of industry and sub-contract for the Maritime Provinces, branch department of Munitions and Supply and Co-ordinator for war industries for the Province of New Brunswick. While managing the Pender business, Mr. Knoll held numerous responsible co-operative offices, including vice-presidency of the Saint John Exhibition Association, membership on the Power Com-

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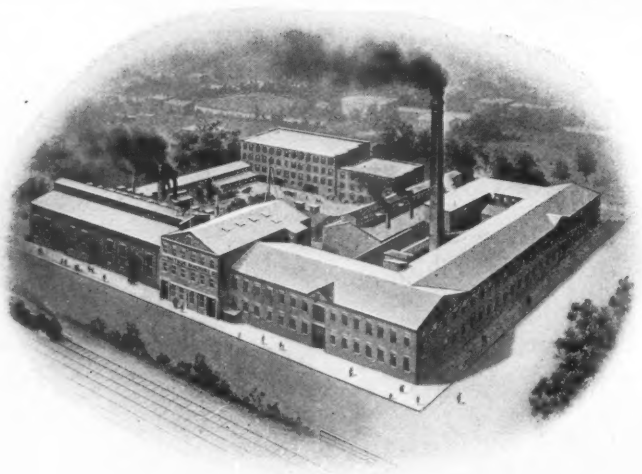

Let-offs
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Traverses
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mission of the City of Saint John; executive member of the advisory committee for industrial and economic relations for the Province of New Brunswick; membership on the management committee of the Union Club and was a director of the Saint John Board of Trade.

✦ ✦ ✦

F. B. DeLong, V. P. and General Manager, Columbia Steel Co.

THE appointment of **F. B. DeLong** as vice president and general manager of sales for Columbia Steel Company, West Coast subsidiary of United States Steel Corporation, was announced by **William A. Ross**, president of the company.

✦ ✦ ✦

MR. DeLONG started his service with Columbia Steel Company in 1937 in Los Angeles as manager of the tubular alloy and stainless department. A few months later he was appointed district manager of sales of the Los Angeles district and in December, 1939, he was promoted to vice president in charge of sales in the Los Angeles district.

✦ ✦ ✦

MR. DeLONG succeeds **J. R. Gregory**, who was appointed vice president of sales of the newly formed Geneva Steel Company, a U. S. Steel subsidiary at Geneva, Utah, where Columbia Steel Company is building the huge $180,000,000 steel mill for the government.

✦ ✦ ✦

Moss A. Kent Appointed W.P.B. Regional Deputy

MOSS A. KENT has been appointed chief deputy regional director of the War Production Board, according to an announcement by the W.P.B.'s New York-New Jersey Regional office.

✦ ✦ ✦

MR. KENT is vice-president and director of manufacturing of General Cable Corp. He obtained leave in April to serve as special assistant to the regional director at a dollar a year. He succeeds **John F. McKernan**, who resigned to resume his duties with Western Electric Co.

✦ ✦ ✦

Wickwire Spencer Appoints T. H. McSheehy to Head Wire Rope Sales Division

WICKWIRE Spencer Steel Company recently announced the appointment of **T. H. McSheehy** as Sales Manager, Wire Rope Division.

✦ ✦ ✦

IN HIS new capacity, Mr. McSheehy will supervise wire rope sales throughout the country. **J. A. Old**, who has been with the company a number of years, succeeds Mr. McSheehy as Pacific Coast Sales Manager.

(*Please turn to Page 662*)

to save more zinc

An improved

FOAMING *liquid blanket.*

Outstanding wire galvanizers know how Dewalco Galvanizing Blanket Crystals seal off the surface of the galvanizing kettles, cutting down zinc losses from oxidation. Now new foaming crystals —F crystals—have been developed which maintain a continuous small cell foam which gives added heat insulation to the kettles and helps reduce dross formation.

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Ask for Dale Gasch at the Hotel LaSalle.

Dewalco Galvanizing Blanket Crystals

plus "F" crystals

a product of DEWEY AND ALMY CHEMICAL COMPANY
CAMBRIDGE 40, MASSACHUSETTS

Outstanding Personalities of the Wire Industry

(*Continued from Page 661*)

MR. McSHEEHY first came with Wickwire Spencer in 1923. During this time he has served in a variety of executive sales capacities, including Hardware Products Manager, Structural Products Manager, Chicago District Manager and Pacific Coast Manager, which position he held at the time of his new appointment.

✦ ✦ ✦

MR. McSHEEHY received a military education and served in the last war through April, 1919, as a Lieutenant in the United States Navy. Before joining Wickwire Spencer, Mr. McSheehy was with the American Steel & Wire Co.

✦ ✦ ✦

HE will be located in the company's General Offices, 500 Fifth Avenue, New York 18, New York.

✦ ✦ ✦

Malcolm G. Kirk, Mgr., American Equipment Div., Pittsburgh Screw & Bolt Corp.

MALCOLM G. KIRK, former manager of the priorities section of the Pittsburgh Screw & Bolt Corp., Pittsburgh, has been appointed manager of the company's American Equipment division at Norristown, Pa., succeeding the late **John A. Longacre.**

✦ ✦ ✦

G. V. Kullgren Joins Farrel-Birmingham Company Akron Office

FARREL-Birmingham Company, Inc., of Ansonia, Connecticut and Buffalo, N. Y., announce the addition of **G. V. Kullgren** to the staff of its Akron, Ohio office.

MR. KULLGREN comes to Farrel - Birmingham Company from General Electric Company at Schenectady, New York, where he was associated with the Industrial Engineering Division, specializing on the application of electrical equipment in the Rubber Industry.

✦ ✦ ✦

FOR several months he represented the Office of Rubber Director, War Production Board, as electrical consultant on the U.S.S.R. Tire Plant project, which involved the design and delivery of the complete tire plant to Russia.

✦ ✦ ✦

BORN in Colorado, he received his B.S.E.E. at the University of Colorado in 1931. In 1933 he joined the General Electric Company as student engineer in the

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UNIQUE

Testing Department at Schenectady. In 1937 he was made Assistant General Foreman of the Testing Department, leaving that position in 1940 to enter the Industrial Engineering Division.

✦ ✦ ✦

T. H. Wickenden, Mgr., Development and Research Div., International Nickel Co.

T. H. WICKENDEN has been appointed manager of the development and research division of the International Nickel Co., and **H. J. French** has been made assistant manager.

✦ ✦ ✦

MR. WICKENDEN, who has been assistant manager since 1931, succeeds the late **Albion James Wadhams.** He was formerly in charge of engineering at Studebaker Corp.'s South Bend plant from 1913 to 1920.

✦ ✦ ✦

MR. FRENCH is temporarily serving in the Steel Division of the WPB in Washington. He has been in charge of alloy steel development in International Nickel's Development and Research Division at New York since 1932.

✦ ✦ ✦

Three G-E Wire and Cable Appointments; Oakland Section Announced

FORMATION of an Oakland (Calif.) Works Section of General Electric's Wire and Cable Division, and the appointment of **B. F. Ilsley** as assistant manager of sales with responsibility over commercial operations there, has been announced by **W. V. O'Brien,** manager of the division. At the same time it was announced that **J. S. Overstreet** was appointed assistant manager of sales for the cable section at Schenectady, and **J. J. Curtin** assistant manager of sales for the magnet wire section at Fort Wayne. The changes became effective September 1.

Henry William Elias

IT is with deep regret that we note the passing of **Henry Elias** of the Firth-Sterling Steel Company on June 10th, 1943 at his home in Flushing, N. Y. Mr. Elias was born February 1st, 1899 in New York City. He graduated from Public School No. 77 and later attended Peter Stuyvesant High School and the Baron De Hurst Trade School. In 1917, Mr. Elias joined the Navy and was honorably discharged in 1919.

✦ ✦ ✦

IN 1919 Mr. Elias became associated with the Union Wire Die Corp., New York City, as a mechanic and later in the capacity of superintendent and then sales engineer, and in 1932 became associated with the Firth-Sterling Steel Company as assistant manager of the Firthaloy Division.

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Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.

A Review of Recent Wire Patents

No. 2,325,766, NAIL AND FASTENER, patented August 3, 1943 by Emanuel Gisondi, Scarsdale, N. Y.

This is a wire clip, adapted as a fastener for wall board, to extend at least partly around a beam and capable of shifting movement thereon under expansion and contraction of the beam, having prongs for engagement and support of the wall board.

✦ ✦ ✦

No. 2,326,022, MANUFACTURE OF NEEDLES AND NEEDLE-LIKE ARTICLES, patented August 3, 1943 by Samuel James Everett, Thornton Heath, England, assignor to Everett Developments Limited, Thornton Heath, England.

More specifically, this refers to knitting machine needles built up of several metallic parts, but may include other types of needles.

✦ ✦ ✦

No. 2,326,120, METAL COATING COMPOSITION, patented August 10, 1943 by George M. Black, Cleveland Heights, Ohio.

The coating comprises from 8% to 60% of chromium soap and a solvent therefor, consisting of a mixture of resin acids and higher fatty acids to dissolve the soap, the composition being free of inflammable ingredients and free of ingredients which cause a film formed at 300° to 600° F. to chip or crack when subjected to expansion, contraction or percussion.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

✦ ✦ ✦

No. 2,326,344, APPARATUS FOR DETECTING VARIATIONS IN WIRE-LIKE BODIES, patented August 10, 1943 by Duryea E. Elmendorf, Cleveland, and Karl H. Keller, Cleveland Heights, Ohio, assignors to General Electric Company, a corporation of New York.

This apparatus includes an oscillator, having a vacuum tube, a resistance, and a tuned work circuit, whereby the apparatus will oscillate electrically when the wire has definite characteristics and will not oscillate electrically when it has other characteristics.

✦ ✦ ✦

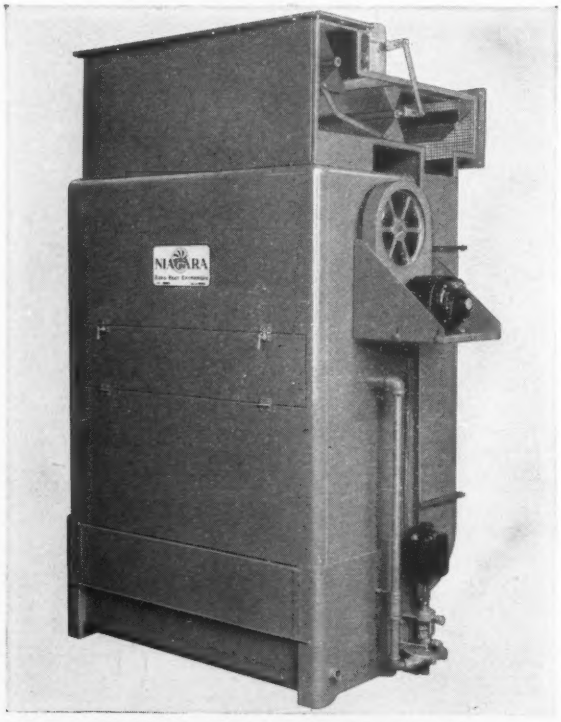
No. 2,327,002, COATED ARTICLE AND METHOD OF MAKING THE SAME, patented August 17, 1943 by John S. Thompson, Detroit, Mich., assignor to Parker Rust Proof Company, Detroit, Michigan.

A method is provided for coating a surface of iron, steel, zinc and their alloys, consisting of applying to the surface to be coated an acidulous, aqueous solution containing the NO_3 radical and a metal from magnesium to nickel, inclusive, in the electromotive series as its chief chemicals and continuing the application of the solution to the surface until a visible, continuous, bonding coating is formed thereon composed essentially of oxides of the metal being coated and the metal from magnesium to nickel, inclusive, in the electromotive series.

✦ ✦ ✦

No. 2,327,149, WIRE DRAWING BLOCK, patented August 17, 1943 by Fritz Zettergren, New Haven, Conn.

The assembly includes a rotatable block having a number of holes concentrically arranged therein on one side thereof, a number of removable pin-like members with one adapted to be disposed in each of these holes, each of the pin-like members having a bayonet locking arrangement disposed on the inner end thereof which is adapted to cooperate with an L shaped slot arranged along the sides of each of the holes, and a spring arranged in the bottom of each of the holes which is adapted to bear against the inner end of each of the pin-like members when positioned in the holes,



U. S. Patent Nos. 2,296,946 and No. 2,321,933

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these springs being adapted to force the pin-like member therein outwardly so that the lug of the bayonet lock on the pin will be forced outwardly and up into the end of the L shaped slot thereby maintaining the pin-like member in a locked position in the hole of the block.

✦ ✦ ✦

No. 2,327,279, SCREW MACHINE, patented August 17, 1943 by Judson H. Mansfield, Rockford, Ill., assignor to Greenlee Bros. & Co., Rockford, Ill., a corporation of Illinois.

More generally, the invention covers a thread-cutting means, particularly the drive and control means for the tap or die-carrying spindle. There are 24 claims.

✦ ✦ ✦

No. 2,327,749, CABLE TIED SPRING UNITS, patented August 24, 1943 by Huot Walter Sternberg, Westport, Conn., assignor to The Owen Silent Spring Company, Inc., Bridgeport, Conn., a corporation of Connecticut.

In this wire coil spring assembly clips are provided for attaching the ends of the coils to the ties, the clips having projections for frictional wedging engagement with the springs.

✦ ✦ ✦

No. 2,328,078, APPARATUS FOR DRYING WIRE SCREEN CLOTH, patented August 31, 1943 by Harry C. Kugler, York, Pa., assignor to Superior Wire Cloth Company, Hungerford, Pa., a corporation of Pennsylvania.

This apparatus is adapted for drying the volatile solvent coating of the wire cloth.

✦ ✦ ✦

No. 2,328,388, HANDLING OF ROD BUNDLES OR THE LIKE, patented August 31, 1943 by Myles Morgan, Worcester, and John N. Whalen, Boylston, Mass., assignors to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts.

There is provided a guideway arranged to receive the bundles and inclined so that gravity will cause the bundles to roll along the same, a reciprocable tray located adjacent the lower end of the guideway and arranged to receive the bundles therefrom, a conveyor adjacent the guideway and adapted to support groups of bundles with the bundles in each group horizontally aligned, the assembly including a device to reciprocate the tray and transfer the bundles from the guideway to the conveyor and form such groups of bundles thereon.

✦ ✦ ✦

No. 2,328,429, MACHINE FOR FORMING WIRE REINFORCED TAPE, patented August 31, 1943 by Herbert Dent, Chicago, Ill.

As a length of cloth tape is advanced, wire carriers rotate about the tape and continuously loop wire thereabout, and cause the wire to be embedded in the edges of the tape.

✦ ✦ ✦

No. 2,328,443, MULTILAYER ELECTRICAL WINDING AND METHOD AND APPARATUS FOR MAKING SAME, patented August 31, 1943 by Levin W. Foster, Pittsfield, Mass., assignor to General Electric Company, a corporation of New York.

If You Are Not A Member of The Wire Association — Now Is A Good Time to Join!
The Annual Dues Are $10.00—For detailed information address
RICHARD E. BROWN, Secretary
THE WIRE ASSOCIATION
300 Main Street, Stamford, Conn.

Layers of insulation between adjacent conductor layers are of gradually varying thickness. There are 18 claims.

✦ ✦ ✦

No. 2,328,513, INSERTION FOR CUSHIONS OR THE LIKE, patented August 31, 1943 by George Torok, Budapest, Hungary; vested in the Alien Property Custodian.

The springs are formed from a continuous length of wire, helics of the springs running alternately clockwise and counter clockwise when viewed from one side of the plane normal to the axis of the springs.

WIRE MACHINERY
Designed and Built by
National Wire Machinery Company

Cable Cutting-Off Machines
Capstan Units, Single and Double Wheel, Straight, Tapered and Grooved Face
Parkway Cable Machines
Compound, Saturating, Wax Tanks—Electric and Steam Heated
Doubling and Tripling Machines
Electric Rod Pointers
Measuring Machines
Take-Up and Pay-Off Reel Stands—Chain, Friction, Motor Driven, With Automatic Traverse
Rereeling and Measuring Machines
Closers and Stranders—Planetary, Rigid, Tubular
Take-Ups—Multiple Head for Tinning, Galvanizing, Patenting, Tempering
Taping Machines — Single Head, Multiple Head Concentric and Eccentric Types, For Paper, Rubber Tapes, Steel, Varnished Cambric, Special Tapes

Complete specifications, layouts and quotations furnished on request.

NATIONAL WIRE MACHINERY COMPANY
821 WASHINGTON STREET, LYNN, MASS.
Successors to
THOMSON-JUDD WIRE MACHINERY COMPANY
SPECIAL CABLE MAKING MACHINERY DESIGNED TO ORDER
TELEPHONE: LYnn 3-3325

The Graphical Solution of Wire Mill Mathematical Problems

(*Continued from Page 598*)

SOLUTION 1: Draw an index line through 13 on the right hand side of the scale D and 2.4 on the "C" scale, to intersect the "P" scale. The intersection of the index line with this "P" scale shows that the coating of zinc is equal to 14 per cent of the product.

PROBLEM 2: A wire having a diameter of .063 inches and a minimum coating weight of .6 ounces per square foot is to be produced from wire stock having a diameter of .135 inches. Estimate the minimum coating weight that the .135 inches stock should bear.

✦ ✦ ✦

SOLUTION 2: Determine the percentage of zinc on the .063 diameter wire as outlined under problem 1. This value is found to be 5.5 per cent. Now with this point on the "P" scale as a pivot point, swing the index line upward to cut the D scale at .135. Read the coating weight on the "C" scale = 1.3 ounces per square foot.

✦ ✦ ✦

Conclusion

AN attempt has been made in the foregoing descriptions to prove the superiority of graphical computation over other methods. A full appreciation of the true value of charts, however, can be gained best through their usage.

✦ ✦ ✦

THE charts presented here, possibly with revisions or extensions to meet the local job requirements, can be put to practical use in the mill. With these as a nucleus, a whole system of charts for solving wire mill formulas can be developed. Such problems as those involving the production of nails, straightened and cut wire, bale ties, and other wire mill products; the distribution of work on a multi-block galvanizing or patenting frame; the calculation of tensile strength, elongation, and other tests; and other specific problems, no matter how complex they may seem, will be found to be easily solved by specially designed charts.

✦ ✦ ✦

THE use of such a system of charts has not only the possibility of saving many hours of arithmetical drudgery but also of raising the efficiency of many operations.

✦ ✦ ✦

Selected Bibliography

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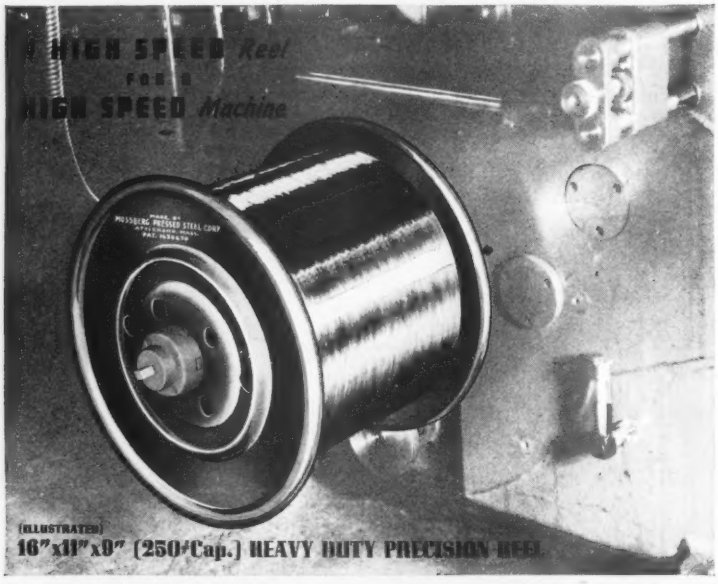


MOSSBERG **PRESSED STEEL** CORP.

OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASS., U. S. A.

Army News Briefs

NOT so long ago on an island in the Southwest Pacific, Signal Corps troops were being driven frantic when they found huge chunks of telephone wire missing. No matter how often they repaired the breaks the depredations continued, and they could find no clue as to what was happening. The mystery was cleared up when a group of these Signal Corps men happened to attend a native banquet. One of them noticed that the strings on a native banjo looked familiar. Closer investigation confirmed his suspicions. They were made of telephone wire. A powwow with native chieftains resulted in a satisfactory solution.

✦ ✦ ✦

ONE Signal Corps telephone operating company in North Africa encountered a new problem in preserving telephone service recently at the Tunisian front. At a headquarters signal office an important communications line suddenly went dead, and no one could account for the trouble. A sergeant finally discovered the difficulty. A drove of camels had been driven into a shady patch beside the headquarters and had begun to munch at grass and telephone lines on the ground with equal relish. The difficulty was cleared up as soon as the camels were driven away.

✦ ✦ ✦

AT the Sacramento Air Depot, McClellan Field, California, as well as at other aircraft repair stations, a new use has been found for coolers and electric refrigerators. The former, once used for keeping ice cream in a frozen state and pop at a cooling temperature, are now storage places for rivets. The latter, in which once were placed food and liquids to prevent their spoiling, now house different types of plastic cement and other rubber and metal glues.

RIVETS for modern planes are annealed to render them less brittle. This demands their being subjected to a high degree of heat and then cooled. Immediately after this heating-cooling process, they are placed in a cooler and kept at below freezing temperatures until needed.

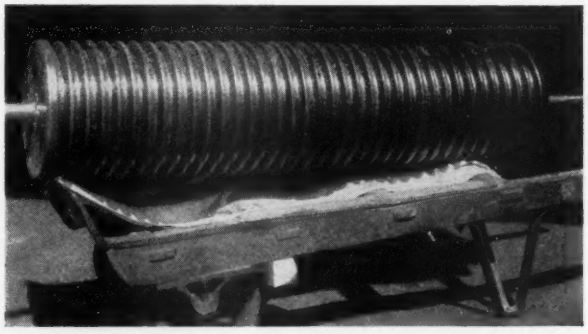
✦ ✦ ✦

Change of Company Name

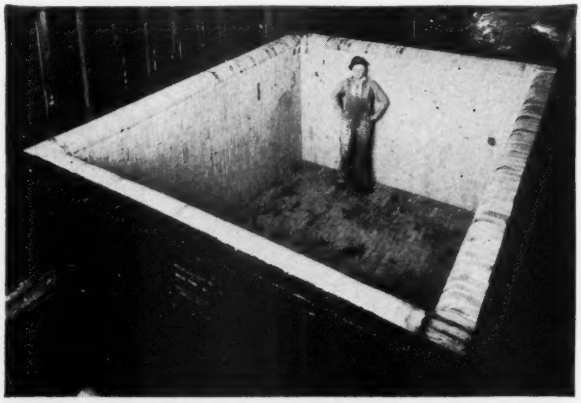
THE Detroit Rex Products Company, Detroit, Michigan, metal cleaning engineers, recently announced a change in firm name to include their trade mark "Detrex". The Detrex Corporation will continue under the same ownership, company policy and management.

✦ ✦ ✦

THIS company, which manufactures degreasers, alkali and petroleum spirits washers and emulsion cleaners, degreasing solvents and alkali cleaning compounds was established in January, 1920.



Guide roll for carrying wire in and out of acid-treating baths.



Example of Pyroflex construction for acid proof tanks.

Acid-Proof Tanks, Linings, Floors for Pickling and Plating.

Guide Rolls, Acid Pitchers, Jars, Valves and Piping.

Knight-Ware guide blocks, rolls and sinkers are entirely acid-proof and abrasion resistant. They are made to order to best meet your requirements. Pyroflex construction tanks, pits and floors provide positive, rugged protection against acid corrosion.

MAURICE A. KNIGHT

Box 111 AKRON 9, OHIO

KNIGHT-WARE CHEMICAL EQUIPMENT

Drawing High Speed Rope Wire

(*Continued from Page 603*)

WE will now go back to our order for .016" Improved Plow Bright wire, for which the #5 Rods have been rolled and tested and are ready for the first processing.

✦ ✦ ✦

THE #5 Rods are first sent to the conventional fuel fired patenting furnaces, where they are air cooled patented to a tensile strength of approximately 150,000# per square inch. The same controls, temperature regulations, and tests are performed as we described for the larger sized wire.

✦ ✦ ✦

THE patented #5 Rods are then cleaned, lime coated and baked, and are drawn on continuous machines to .124", a reduction in area of 68%. This hard drawn .124" wire is then returned to the patenting department, where it is again air cooled patented on a small fuel fired furnace, and again returned to the Cleaning House to be cleaned, lime coated and baked.

✦ ✦ ✦

THE .124" patented wire is ready for the second drawing and this is again performed on continuous machines in drawing to .051", a further reduction in area of 83%. The hard drawn .051" wire is now ready for the last and most important patenting. This is performed on an Electric Resistance Patenting Furnace. By use of this method of patenting, we are able to produce this wire with a patented tensile strength of about 160,000# and with a reduction in area of the tensile break of about 60%, and with a high degree of uniformity in structure throughout the coil. The scale on this wire is so light and so fine and powdery that very little acid cleaning is required, but, of course, even this small amount of oxide must be removed, so the .051" Electric Patented coils are taken to a small cleaning room, where they are carefully cleaned and lime coated in tubs just large enough for one (1) coil at a time. The lime coated coils are then baked, either in a circulating atmosphere oven type baker, or in a flash baker.

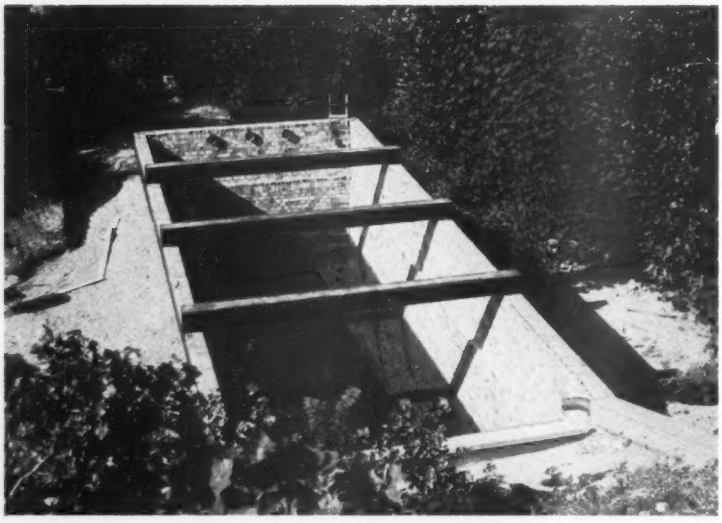
✦ ✦ ✦

WE are now ready for the final drawing from .051" Electric Resistance Patented stock to .016" Bright Wire. This is accomplished in eight (8) continuous holes or drafts on a water-cooled machine at a finishing speed of about 1200 F.P.M. on a 12" finishing block. This final drafting is a 90% reduction in area.

✦ ✦ ✦

IT is interesting to note that in the case of the .091" wire from an original 17/64" (.265") rod that the total reduction in area from rod to finished wire amounted to 89%; but it is still more interesting to note that in the case of the .016" wire, we have started with a commercial #5 Rod (.218") and have performed a total reduction in area of 99.44% and if we can believe all the advertisements we read, then that is pure soap — or pure wire.

BASOLIT
Acid *Neutralizing* Tank



● 2500 gallons of waste pickling acid are dumped every 24 hours into this 90,000 gallon acid disposal tank installed 3 years ago for a large wire mill in the Mid-west.

● Tank is 60 ft. long, 20 ft. wide and 12 ft. deep, constructed of reinforced concrete shell, lined with TORONTO Acid Brick and acid-proof jointing Cement, BASOLIT.

● There are many hundreds of rubber lined steel and reinforced concrete pickling tanks, acid storage and neutralizing tanks and acid floors, sewers and pits, where our BASOLIT construction has contributed to long life and efficient operation of modern pickling equipment.

● Our Engineering Department will be pleased to furnish detailed drawings and estimates without cost to you.

NUKEM PRODUCTS CORP.

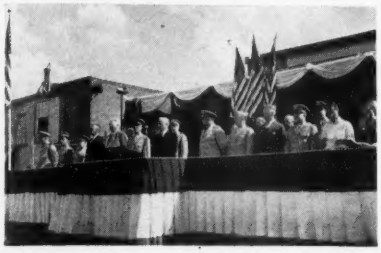
BUFFALO, NEW YORK, PITTSBURGH, STEUBENVILLE, O., DETROIT, CHICAGO — KITCHENER, ONT.

Pacific Coast Representatives
Kraftile Company
Los Angeles, Niles, San Francisco, Seattle, Washington

Southwest Representatives
Elgin-Butler Brick Company
Austin, Dallas, & Houston, Texas

Army-Navy Production Award

WITH appropriate services, the men and women of the Dewey & Almy Chemical Company of Cambridge, Massachusetts, were awarded the Army-Navy "E" Production Award for exceptional performance on the production front.



THE wire industry knows the Company best through its manufacture of Dewalco Liquid Blankets to prevent the formation of zinc oxide in the hot galvanizing of wire, although they also make a line of chemicals having other industrial applications. The Company now has 233 employees in various branches of military service. **Mr. Bradley** accepted the award for the plant and employees and **Lawrence J. Melia** represented the employees in the award of the "E" pins.

✦ ✦ ✦

The New Improved Universal Cable Splicer

THE Mechanics Engineering Company, of Jackson, Michigan, has developed an improved design of cable splicer to meet the demands of wartime service. It is sturdily built of wrought iron, with fittings of manganese bronze.

✦ ✦ ✦

THE splicer for which patents are pending, is known as the Universal No. 101. It requires no adapters to handle the several sizes and types of thimbles and bushings most widely used. They are firmly held by means of a sprocket chain and powerful jaws. Adjustment of the chain hold to various sizes of bushings and thimbles is made by setting and locking a single button.

THE Universal Splicer can be used in the standard furnished, which can be bolted to a bench. Also, it can be set in a vise or held in the hand. It will prevent any bulge in the cable. Tendency to bulge is controlled by the chain as the splicer is tightened around the bushing.

✦ ✦ ✦

THE splicer is in successful use both in maintenance and production work, where it meets the requirements of dependability and speed.

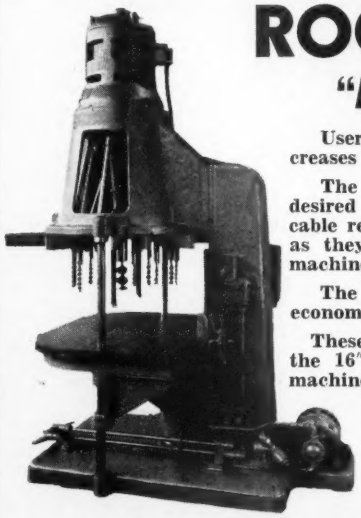
✦ ✦ ✦

Fidelity Machine Company Wins Army-Navy Production Award For Second Time

UNDER Secretary of War, **Robert P. Patterson** of the War Department, on September 4, 1943 advised the Men and Women of the Fidelity Machine Company that they had won for the second time the Army-Navy Production Award for Meritorious Service on the production front.

ROOT CABLE REEL BORERS

"A Cable Reel Side Bored with Each Feed Stroke"



Root Style "AMH" 27" Round Hood Cable Reel Borer

Users of these borers report production increases up to 500%.

The adjustable spindles are centered for the desired pattern of holes. After that assembled cable reel sides will be accurately bored as fast as they can be handled into and out of the machine.

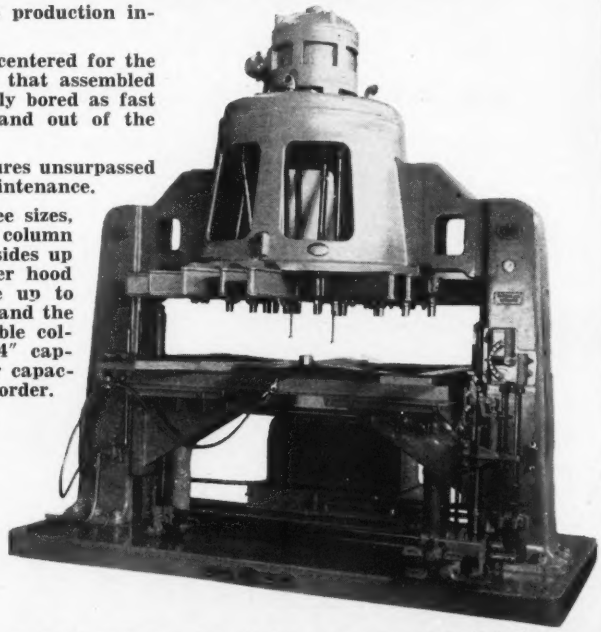
The hydraulic table feed assures unsurpassed economy of production and maintenance.

These borers are built in three sizes, the 16" diameter hood single column machine will handle cable reel sides up to 32", the 27" diameter hood single column machine up to 42" diameter and reels and the 40" diameter hood double column machine up to 84" capacity reel sides. Larger capacity machines built on order.

Let Root solve your cable reel boring problems. Send us blueprints of your reel boring jobs.

B. M. ROOT CO.

YORK, PENNA., U. S. A.



Root Style "AMRH" 40" Double Column Round Hood Cable Reel Borer.

Fiberglas as an Electrical Insulation

(*Continued from Page 626*)

clude generators, and motors for variable pitch propellers, landing gears, gun turrets, gun elevators and superchargers. Fiberglas also equips navy motors which require special consideration for moisture and salt water resistance and where space and weight are of importance.

✦ ✦ ✦

ANOTHER timely example of how Fiberglas is being used is in the recently developed army aircraft ignition cable. This new construction has been designed through the cooperation of the cable and engine manufacturers, the testing agencies and Army Air Force. It out-performs the ignition cable previously used in so many ways that all ignition cable manufacturers have now been called upon to produce it exclusively for the armed forces. Fiberglas has contributed to the outstanding performance built into this new cable by its corona resistance, its high tensile strength and its heat, moisture and acid resisting properties.

✦ ✦ ✦

FOR radio hook-up wire, Fiberglas is playing an important part. Today, about eighty per cent of the wire used in aircraft radio equipment is Fiberglas insulated. This insulation is fungus proof, flame proof, resists damage from solder burns and can be used where small space factors are important. The construction of this cable and primary aircraft cable is practically the same. These two cables have a primary insulation, a fibrous covering and an outside lacquer coating. The primary insulation is usually in the form of a resinous tape or extrusion directly over the wire. In the tape construction, two braids may be used, but if an extrusion is used, only one braid can be applied and still retain the proper outside diameter.

✦ ✦ ✦

ALL the tapes and extrusions used so far have low temperature characteristics; therefore any treatment applied to a Fiberglas braid over them must be one which will cure at a low temperature. This excludes all but a few of the types of resins which might be used as a treatment to decrease moisture absorption and increase abrasion resistance. Considerable work has been done on this problem and we have just recently found a few resins which can be cured satisfactorily at low temperatures and still improve these characteristics. Some of these treatments will give a Fiberglas braided cable better abrasion resistance than has hitherto been obtained.

✦ ✦ ✦

Future Applications

FROM its start, the growth of Fiberglas for the electrical industry has been slow and healthy. Today, because of the war emergency, its progress has been more rapid, although it is used only where it has proven itself by giving better performance than other materials. Today these uses are so many and varied that Fiberglas is recognized as a basic engineering material in the electrical field. Engineers and designers are be-

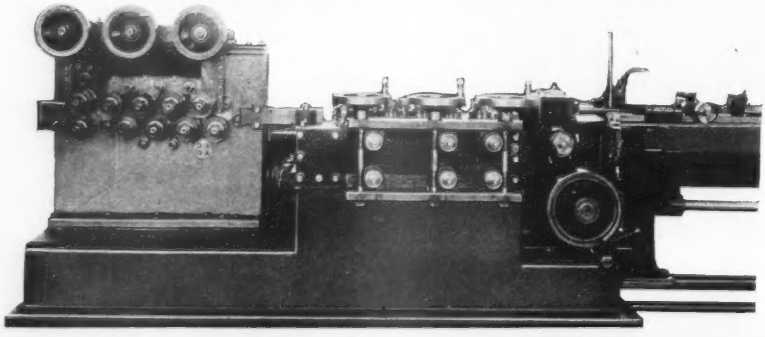
AUTOMATIC SHAPE STRAIGHTENER

with

FLYING SHEAR

for

Hexagon, Square and Rectangular Material



Will produce uniform quality rod without marking. Also high production, with accurate lengths.

THE HALLDEN MACHINE COMPANY

THOMASTON, CONNECTICUT

coming better acquainted with its properties and will undoubtedly find still more uses for it. They are finding better companion materials which may be used with it in order to obtain the most out of the resulting combinations.

✦ ✦ ✦

THE textiles used in electrical equipment are no longer the limiting factor in design; such things as impregnants, bearings and lubricants are now the chief construction problems. For example, even though the ultimate in life and temperature can be obtained from present impregnants, still better materials are needed. Considerable improvement has recently been made in this field by the varnish and resin manufacturers.

✦ ✦ ✦

SOME entirely new synthetic resins are also being tried with Fiberglas which have unusually high heat resistance. So far, most of these also require high heat for curing and in some cases new equipment must be built. These new materials are still limited in production and restricted to special wartime applications, but for post-war uses, coupled with Fiberglas, they show promise of accomplishing great things in electrical design.

✦ ✦ ✦

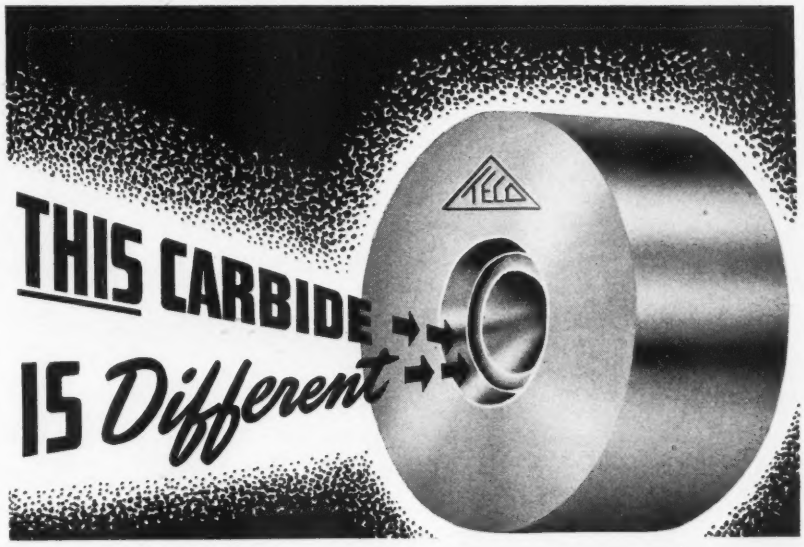
AIRCRAFT acoustical insulation, surgical sutures, tracers for surgical sponges, blood plasma filters and reinforced plastics are other present time developments. In peace-time, Fiberglas is expected to invade many new fields, such as, non-inflammable decorative fabrics, structural elements for household use, plastic reinforcement for industrial use, new thermal and acoustical insulation for architectural use, tire cord fabric, other rubber combinations in the automotive field and in many similar applications. Many of these possibilities indicate the employment of Fiberglas in comparatively large volume.

Bed Springs

PERMISSION to use rail steel angles and Bessemer or low carbon steel for frames and borders in the manufacture of coil, flat and fabric bed springs was granted by the War Production Board. Action was taken in an amendment to Order L-49.

✦ ✦ ✦

IN ORDER to permit use of this material, manufacturers' quota allowances of iron and steel for bed spring production during the three months beginning July 1, 1943, have been increased from 3-⅓ per cent to 10 per cent of the amount used by each manufacturer in his aggregate production of coil, flat and fabric bed springs (which were not integral parts of beds or other sleeping equipment) during the base period — July 1, 1940 - June 30, 1941.



ALL Carbides alike? Not by a long shot! TECO Carbides, made to rigid standards, are harder, denser, more uniform . . . thus have greater resistance to wear. This gives TECO Carbide Dies unusual capacity for high-speed, long-run production of smooth, on-size wire. Your increased tonnage per die will soon demonstrate this difference.

Remember — it's the Carbide that does the work. Use the best . . . TECO! Our engineers will gladly discuss your requirements.

WIRE and BAR DIES

EXTRUDING DIES

TUBING DIES

SIZING DIES

•

Carbide Blanks, Tools, Bits, Reamers, Broaches, Forming Tools

TUNGSTEN ELECTRIC CORPORATION, 564-39th Street, Union City, N. J.

TECO Pioneers in Tungsten Carbides for over a Quarter Century **CARBIDE DIES**

OXYGEN FREE HIGH CONDUCTIVITY COPPER

OFHC
REG. U.S. PAT. OFF.

OFHC is a versatile copper.

It is an essential part of electronic devices.

In that capacity it is accompanying our armed forces everywhere.

Its unique qualities however do not restrict its use to special applications.

OFHC is a universal copper.

THE AMERICAN METAL COMPANY, LTD.
61 Broadway, New York, N. Y.

THE WIRE ASSOCIATION
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1. WIRE & WIRE PRODUCTS — For One Year.
   The official publication of The Wire Association covering the Wire Industry; its Metallurgy, Technology, Research, Processes, Machinery and Personnel.
2. THE ANNUAL BUYERS GUIDE & YEAR BOOK OF THE WIRE ASSOCIATION.
   The Year Book Section contains: Constitution and By-Laws of The Wire Association; Details of year's meetings, etc.; List of Members, Index to Papers and Articles in WIRE & WIRE PRODUCTS.
3. QUESTION AND ANSWER SERVICE.
   Answers to technical and operating problems direct by mail. Available to members only.
4. ANNUAL CONVENTION AND EXHIBITION.
   (In Association with American Society for Metals and The National Metal Congress.) Technical Sessions, Plant Inspections.
5. REGIONAL MEETINGS.
   Attendance at the regional meetings which include Local Plant Inspections, Technical Sessions and Discussions.
6. PERSONAL CONTACTS.
   Both at Annual and Regional Meetings, and throughout the year, for interchange of helpful information.
7. INFORMATION SERVICE ON MACHINERY, EQUIPMENT AND SUPPLIES.
   The Technical, Catalogue and Correspondence Files of the Wire Association hold the answer to practically every "Where can I buy" problem. This service is available to members without charge.

For detailed information address

RICHARD E. BROWN
Executive Secretary
300 Main Street, Stamford, Conn.

The Properties and Uses of Vinyl Resins for Wire and Cable

(*Continued from Page 617*)

loss communication cables, and even on these the resins are used as jackets. It is almost easier to point out the exceptions to their use than it is to name the uses. To be more specific than that however, a possible general classification of uses is given below in a brief outline. The outline is based upon general location groupings and does not indicate every detailed use.

✦ ✦ ✦

Uses for Wire and Cable Insulated or Jacketed with Vinyl Resins

Aircraft

Low tension wires, power, control and communication. (Also used in tubings and as protective coverings on conduits and fabrics)

Automotive

Low tension wires, power, control, radio, instruments, etc. (Also used in tubings and as protective coverings on conduits and fabrics)

Communication

Insulation on short runs such as indoor telephone wire, cords, drop wire, switchboards, jackets on cables both low and high-frequency, portable cords and cables.

Construction

General building wire such as type SN, non-metallic sheathed cables, bell wire, cords, etc.

Industrial

General wiring of electrical equipment, machine tools, portable cords of all types, signal systems, low voltage power and control wiring, mine and oil well cables, etc.

Marine

Low voltage power and control wiring, instruments, switchboards, etc. Telephone wire for cable, switchboards, cords, etc. Radio hook-up wire and jackets for high-frequency cables. (Tubing and tapes are used for protective purposes also). Under water power, signal and control systems.

Utilities

Jacketing for power and lighting cables, insulation for airport lighting, general control, switchboard use and secondary circuits.
Service entrance, parkway and portable cables.

✦ ✦ ✦

BESIDE the above uses there are probably many others that may be apparent to users. In thinking of other and new applications it is only necessary to keep the limitations well in mind and to keep an open mind towards new types of cable constructions made possible by thinner walls of insulation and the other advantages of the vinyl resins.

✦ ✦ ✦

MANY questions have been raised concerning the future of these vinyl resins for wire and cable use. The manufacturers of the resins are of course inclined to be optimistic and fortunately the wire and cable manufacturers and users have also been fairly optimistic. In the emergencies of wartime operation many new constructions have been tried, the pressure has been great to discontinue the use of natural rubber, —the result has been the trial of these resins in many applications where otherwise they might never have been considered. In most instances they have proven themselves well, so well that they will undoubtedly continue in use after

the war emergency has passed. The flame-proofness, light-weight, high dielectric strength and oil, acid and aging resistance are so superior to natural rubber compounds that in a great majority of cases the industry will never return to rubber unless governmental controlled economy should rule otherwise.

✦ ✦ ✦

Catalog Describes Material Handling Equipment

A NEW 60-page catalog, bound in heavy paper covers, has just been issued by the American Monorail Company, 13107 Athens Avenue, Cleveland, Ohio.

✦ ✦ ✦

THIS book, profusely illustrated, to show the numerous applications of American Monorail to the industry is full of ideas that will help plant managers and engineers to solve their own material handling problems.

✦ ✦ ✦

BESIDES pictures showing ing monorail systems in operation, there are several pages of drawings showing details of construction, and in the back several pages devoted to a description of their engineering service, to engineering data and layout information.

✦ ✦ ✦

THE book will be sent to interested parties upon application to the Company. Ask for their new book on "Overhead Handling Equipment."

✦ ✦ ✦

Bristol Company Gets "E" Award

THE Bristol Company of Waterbury, Conn., well-known as manufacturers of recording and control instruments, was given the Army-Navy Production Award on July 29th, 1943. **Mr. Howard H. Bristol,** President of the Company, accepted the award for the Company, and **Walter H. Roberts** acted in a similar capacity in receiving the "E" pins given to the employees as a mark of recognition for their part in the production records achieved.

A BULLETIN THAT WILL HELP--

1 SPEED PRODUCTION
2 CUT COSTS
3 IMPROVE QUALITY

Wire drawing lubricants are highly specialized. And when you take the time and trouble to test various materials on your particular operations, you are certain to find one that will do a better, faster and more economical job.

YOURS FOR THE ASKING!

MAGNUS WIRE DRAWING COMPOUNDS

cover the entire range of wire drawing—wet, dry and grease drawing, on ferrous and non-ferrous wire. One of these may prove to be just what you need—as was the case with many producers of high carbon steel wire who have found in Magnus 52c-1 a perfect solution of their problem of getting high speed drawing in multi-pass operations. 52C-1 stays with the wire to the sixth draw, speeding up production by over 40%.

MAGNUS CHEMICAL COMPANY
188 South Avenue, Garwood, N. J.

Magnus CLEANERS

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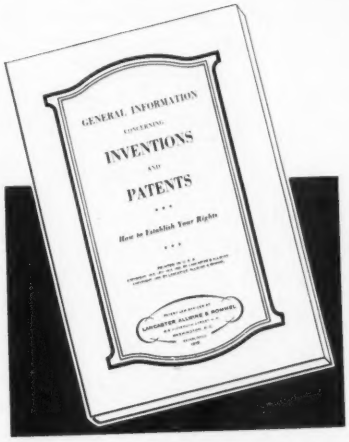
PROTECT YOUR PRODUCTS
Your good-will and advertising matter



1. By Design Patents protecting new and ornamental shapes of wire products.
2. Patents covering new equipment methods or processes used in the wire industry.
3. Patents on new compositions of matter or compounds, used in the wire industry.
4. Registration of trade-marks in the United States Patent Office —"Reg. U. S. Pat. Off."
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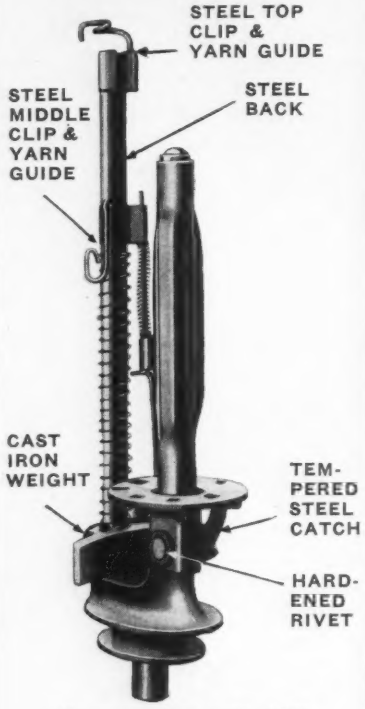
438 BOWEN BUILDING Established 1915 WASHINGTON, 5, D. C.

"SPEEDWAY" CARRIERS
for all
BRAIDING MACHINES



The carrier above is No. 1/900 A.C. Patented in all leading countries.

"Speedway" carriers are light, exceedingly strong, of accurate construction, and designed to give long, trouble-free life, in precision braiding of wire. Weighs only 9½ ounces.

Simple to handle. For example, a change of springs can be made easily, without the use of tools, in a few seconds.

Send for Catalog No. 10/4 and prices. Full details, description and specifications of all Carter carriers are given.

B. & F. Carter & Co., Ltd.
ALBION WORKS
WATERLOO STREET
BOLTON • ENGLAND

High Tensile Bolt Production

(*Continued from Page 659*)

are the most important steps in the production of sound, clean wire. In developing a method of melting control it is customary to establish a crew of observers in the Melting Department. These men are usually young graduate metallurgists and they are in physical contact with a given heat of steels from the time it is charged until it is poured into the ingot molds. A very accurate melting log is kept and no small detail is overlooked. Routine tests for metal analysis are made, but more important is the slag tests, from which the iron oxide balance is determined. Every factor of time and temperature are observed and the data obtained are checked against the final product. In casting, temperature control is of prime importance and care is given to the selection of size of ladle nozzle, depending upon the type of steel and ingot mold sizes. Ingot molds designed with the big end up are practically standard in this country. It is believed that very little can be added in connection with blooming, billet and rod rolling. If for any reason, chipping is necessary, the extra cost of conditioning the blooms will appear insignificant compared to the loss of the finished product by rejections. The ill effect of over-drafting is so well known that it does not warrant a remark of caution.

✦ ✦ ✦

No. 4. It is believed that intermediate heat treatment of rod or wire has little bearing on the ultimate surface quality of common or plain carbon wire. It does no doubt ease the tendency to develop defects in alloy wire.

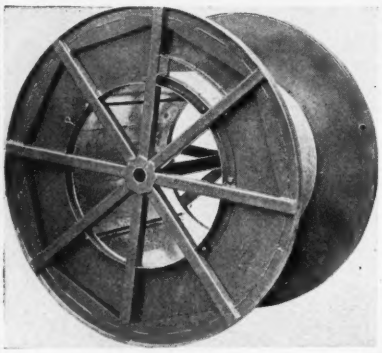
✦ ✦ ✦

No. 5. As mentioned above, the rejection of bolts due to wire defects would not be tolerated and it is quite within the realm of the steel maker to eliminate the source of the trouble. It is inconceivable that the steel makers of England could not develop melting

(*Please turn to Page 686*)

ALL STEEL REELS

FOR SHIPPING
FOR STORING
CABLE AND WIRE



Last Longer

Constructed of corrosion resisting materials, three to four times the life of a wooden reel is a reasonable expectancy.

Give Greater Protection

Smooth inner surfaces, much greater strength with the absence of all cutting or abrading projections — these protect not only the cable but the men handling it.

Save On Freight

Appreciably lighter than wooden reels — cost less to ship — a cumulative saving that more than offsets increased first cost.

Reduce Investment

The longer life of R. B. Hayward Steel reels reduces the investment in reel equipment.

Write for description of construction and prices.

R. B. HAYWARD CO.
1714 Sheffield Ave.
Chicago, Illinois

Apco-Mossberg Corp. Awarded Army-Navy "E"

ON Aug. 16, 1943 the highest tribute, which the armed forces of the nation can pay to those who keep them supplied from the home front with the materials of war, was bestowed on the men and women of the Apco-Mossberg corporation when the Army-Navy "E" pennant, symbol of excellence in the production of vital war supplies, was raised on the flagstaff of the plant.

✦ ✦ ✦

THE Apco-Mossberg Corporation plant became the third in Attleboro, and one of less than a dozen in this section of the Bay State to be entitled to daily fly the "E" pennant from its flagstaff.

✦ ✦ ✦

IT was the Mossberg company in 1898 when the Spanish-American War was waged with quick and successful conclusion by the American War Department. It was the Frank Mossberg company in 1916-18 when again materials were produced to aid the nation in the successful prosecution of a war.

✦ ✦ ✦

THE modern Apco-Mossberg company the firm which is today honored, has a more recent organizational history however, going back to 1936. It was in this latter year that **Leland B. Smith,** president of the firm, took over, and began perfecting the organization which has achieved one of the most outstanding production records of any in its field, in connection with its war effort.

✦ ✦ ✦

MR. SMITH had a background of service with the previous organization and with the Frank Mossberg company. He came to the latter firm at the conclusion of service in World War I in which he was a commissioned artillery officer.

✦ ✦ ✦

OTHER officers of the firm are **J. G. McGreevy** and **William A. Blackburn,** vice presidents, and **C. Duncan Smith,** assistant treasurer.

APEX "PIC-KLEEN"
FOR RODS AND WIRE

Many mills developed new concepts of cleaning house practice after using "PIC-KLEEN". Used on high and low carbon stock and most alloys, it will speed production and cut expense. It will do these things:

Eliminate lime in many cases
Do away with the sull coat operation
Inhibit rust under adverse storage conditions
Greatly increase the life of drawing dies
Reduce the consumption of die lubricants
Lowers material handling costs

COSTS LITTLE—SAVES MUCH

Investigate Today — Write for Details

APEX ALKALI PRODUCTS COMPANY
MAIN AND RECTOR STREETS
PHILADELPHIA 27 • PENNSYLVANIA

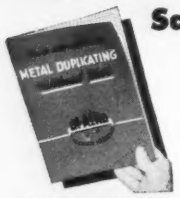
SHEARS
Di-Acro Shear squares and sizes material, cuts strips, makes slits or notches, trims duplicated stampings. Shearing widths — 6", 9", 12".

BRAKES
Di-Acro Brake forms non-stock angles, channels or "Vees". Right or left hand operation. Folding widths — 6", 12", 18".

BENDERS
Di-Acro Bender bends angle, channel, rod, tubing, wire, moulding, strip stock, etc., 2 sizes. Capacity up to ½" cold rolled steel bar.

WOMEN AT WAR

Saving Man Hours and Critical Materials



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"METAL DUPLICATING WITHOUT DIES"

No delay waiting for dies — parts ready quicker — deliveries speeded up — all to bring the Victory sooner! Women are rapidly taking a major place on the industrial front. DI-ACRO Precision Machines — Shears, Brakes, Benders — are ideally suited for use by women in making duplicated parts accurate to .001" — DIE-LESS DUPLICATING. Thousands of DI-ACRO Machines are now in use in War plants.

O'NEIL-IRWIN DI-ACRO PRECISION MACHINES MFG. CO. 303 8th Avenue So. Minneapolis 15, Minn.

New! HEAVY DUTY MILLS
Size 20 & 22 x 60 Inch

for·· Compounding and Warming of Synthetic Rubber and Tough Resins. Custom built to your requirements.

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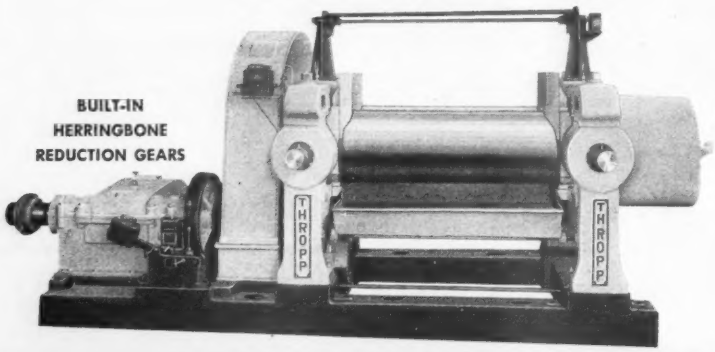

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WASHERS CRACKERS REFINERS CALENDERS

Wire Association Convention Highlights

The Mordica Memorial Lecture

EACH year the Wire Association selects as the Mordica Memorial lecturer, a metallurgist whose work during the year has been outstanding in its benefit to the industry.

✦ ✦ ✦

FOR 1944 the honor goes to **Flint C. Elder,** Research Engineer of the American Steel & Wire Company, Cleveland, Ohio. The title of Mr. Elder's paper will be "The Wire Drawing Die."

✦ ✦ ✦

IN the paper he will develop a general formula for die pull in drawing steel wire through tungsten carbide dies, backing up and proving the formula by a series of tests using dies with entrance angles from 30° down to 4° for low carbon, medium carbon and high carbon steels, and will show some practical applications for such a formula.

✦ ✦ ✦

"Designing Mills for Government Purposes"—Lecture

By Paul M. Mueller,
Engineer,
Revere Copper & Brass Co.,
Rome, New York.

THE author has had a great deal of experience in handling several multi-million dollar government finance plans for the Revere Copper & Brass Co., and presents a study with the aid of motion pictures of the many subject problems found necessary for solution in the design of a mill for particular government purposes. This lecture will not be published.

✦ ✦ ✦

"Work Done at High Speed or in a Hurry"

By Allan H. Mogensen

MANY people today feel that the way to increase war production is to install an incentive plan — almost any incentive plan. The speaker will discuss bad policies and show how better and

easier ways of doing work will improve productivity more than merely installing a wage incentive. This lecture will not be published.

✦ ✦ ✦

ALLAN H. MOGENSEN became interested in motion study and the use of the motion-picture camera in 1924. He was impressed by the tremendous possibilities for work in this field, as yet little used by industry, in the elimination of wasted time and effort.

✦ ✦ ✦

SINCE 1930 Mr. Mogensen has been a member of the editorial staff of FACTORY; he is the author of "Common Sense Applied to Motion and Time Study," and of papers published in numerous technical magazines, in this country and abroad.

ALLAN H. MOGENSEN,
Editorial Staff
"Factory"

ALL his time since 1932 has been devoted to conducting training programs in Work Simplification. Mr. Mogensen has trained representatives of many organizations, which has enabled them to conduct their own Work Simplification programs. He also conducts programs himself and for the past two years has been devoting nearly all his time to conducting programs in the airplane industry.

(*Please turn to Page 678*)

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MANUFACTURERS
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FINE WIRE

Brass	Aluminum	Phosphor Bronze
Steel	Nickel Silver	Brush Wire
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Spring Wire	Mandrel Wire	Weaving Wire
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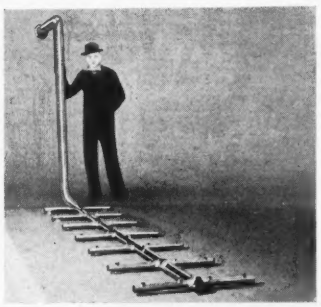
Flat and Special Shapes



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WITH HEIL STEAM-AIR AGITATOR

JETS

SAVES ACID
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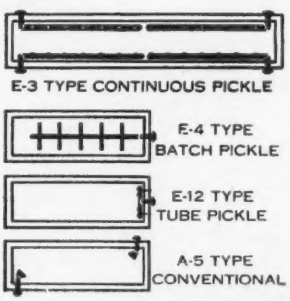
UNIFORM HEATING
●
MORE CHEMICAL ACTION
●
CUTS REJECTS



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20% TO 40% MORE PRODUCTION
PROVEN IN MILL PRACTICE

The complete HEIL line includes pickling, anodizing and plating tanks, lead and carbon heating coils, syphons. Write us for details.

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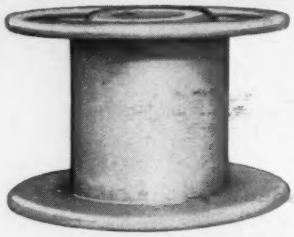
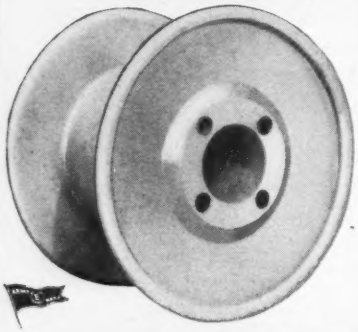


APCO MOSSBERG
PRECISION
STEEL REELS



The reels that are engineered to the job... designed and built by the company that originated the steel reel idea . . . are the reels you should be using in your plant. Every year, more and more Apco Mossberg Steel Reels are bought by quality-minded buyers throughout the wire industry.

FREE
ENGINEERING SERVICE

Without obligation to you, Apco Mossberg engineers will be glad to study your reel problem, and supply complete suggestions, drawings, blue prints. Write for information today.

REELS..SPOOLS..BOBBINS

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(THE ORIGINAL FRANK MOSSBERG CO.)
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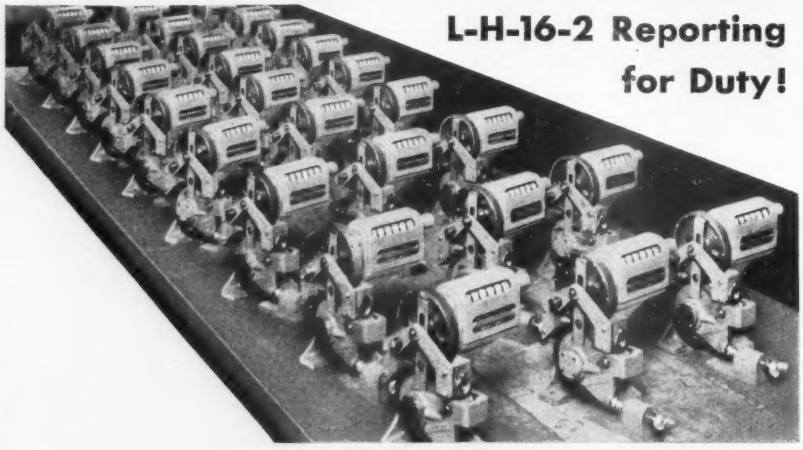

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As essential to the Wire Industry as the Wire Industry is to the War effort, Productimeters are in service, day and night, measuring production of various machine operations . . . accurately, at high speeds. There's a unit for every wire measuring requirement . . . for every type of product . . . they're ruggedly built, designed to do the work you *expect*. If you have an urgent counting problem, write for our recommendations and

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PRODUCTIMETERS
THE SPEEDOMETERS OF INDUSTRY

Convention Highlights

(*Continued from Page 677*)

"Drawing High Speed Rope Wire"

By John C. Aiken,
Asst. Supt. Rod & Wire Dept.,
Jones & Laughlin Steel Corp.,
Aliquippa, Pa.

THIS paper is a discussion of the problems encountered in drawing rope wire for steel wire rope, and presents a comparative study of various practices involved.

✦ ✦ ✦

"The Graphical Solution of Wire Mill Mathematical Problems"

By E. J. Crum,
General Foreman,
Bethanizing & Galvanizing Depts.,
Rod & Wire Mills,
Bethlehem Steel Company,
Sparrows Point, Md.

HERE is a presentation in graphical form of some of the more common mathematical problems met with in the everyday operations of a wire mill. From the operating man's viewpoint the working charts shown will be found to be of great value and a very practical aid in the everyday operation of the plant.

✦ ✦ ✦

"The Use of Lead Base Coatings As a Substitute for Zinc"

By C. A. Kellogg,
Chief, Dept. of Metallurgy
and Inspection,
Continental Steel Corp.,
Kokomo, Indiana.

THE subject matter of this paper is necessarily more or less of a general nature but with specific reference to problems now under consideration in the industry where lead base coatings are required as a substitute for zinc.

✦ ✦ ✦

THE paper is designed to be provocative of discussion on the subject. This paper was not received in time for publication in the October issue of "WIRE & WIRE PRODUCTS" but will be published in the November issue.

"Hydrogen Brittleness in Spring Steels"

By Rodman R. Tatnall,
Metallurgical Engineer,
Morgan Works, Wickwire Spencer Steel Co.,
Worcester, Mass.

THIS paper deals with several phases of acid brittleness induced in several high carbon types of spring steels. Pickling, plating, etc., are dealt with briefly and some data on the nature and extent of brittleness under different conditions is presented. It is not intended to be a paper on plating as such, but is intended to cover the effects on quality arising from various processes which may set up this type of brittleness.

✦ ✦ ✦

"Fiberglas as an Electrical Insulation"

By Lester T. Russell,
Engineer,
Owens-Corning Fiberglas Corp.,
Newark, Ohio.

FROM its early development in 1931 to today we now have today over 300 fiberglas products. This paper is a description of fiberglas as an electrical insulation with particular reference to wire and cable. An outline of the types of fiberglas, the manufacturing processes, the properties of fiberglas and the variety of uses, is presented. Specific information is also given on the uses of fiberglas for covering wire as an electrical insulation and as a heat insulator.

✦ ✦ ✦

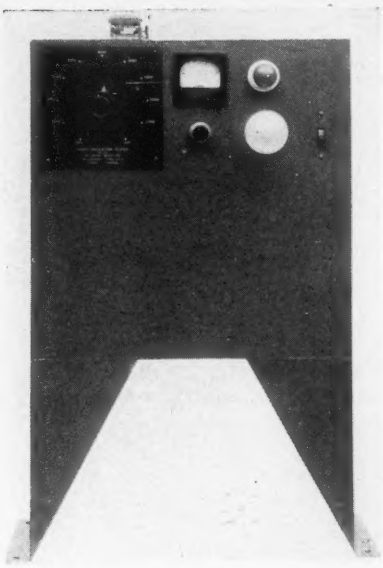
"Discussion of Electrical Tapes for Wire Insulation"

By Paul W. Kollar,
The Dobeckmun Co.,
Cleveland, Ohio.

THE author presents a study of the use of electrical tapes for wire insulation which is extremely interesting in view of recent developments in the manufacture of electric wire and cable. This paper will be of real interest.

(*Please turn to Page 680*)

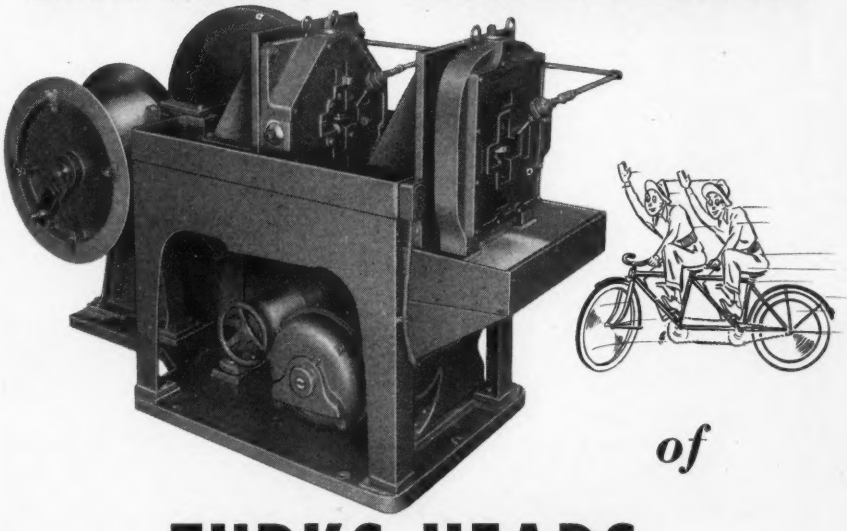
SPARKER for SYNTHETIC EXTRUSION COMPOUNDS



THIS APPARATUS WILL LOCATE DIELECTRIC FAULTS while the wire is being insulated. When breakdown occurs, the operator is notified by an audible alarm. A resettable counter gives the number of faults in each reel. By sorting out the defective reels in this operation, the majority of the resparking is eliminated. Continuous range of voltage at the electrode is from one thousand to sixteen thousand kilovolts. The sparker is equipped with voltmeter reading in kilovolts, and automatic interlock with the takeup motor.

R. L. Davis Electric Co.
Wallingford, Conn.

"Standard's" TANDEM MOUNTING



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TURKS HEADS

for breakdown and finishing operations in one draw at variable speeds to 140 feet per minute. Wire capacities from 1/8" to 1" drawn to specified shapes.

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STANDARD MACHINERY CO.
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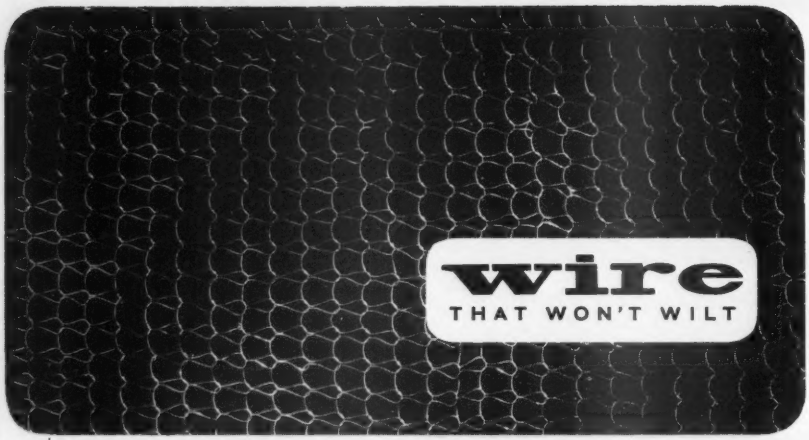
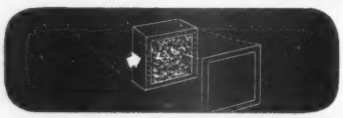


A RESILIENT PACKING to withstand high temperatures was devised by knitting a mesh stock of fine Callite .009" Bethanized Steel wire. This knitted wire mesh is now serving as an air filter in a wide variety of military applications from heating systems to army trucks. It was developed by the Metal Textile Corporation of Orange, N. J., as a product of war necessity with many future potentialities.

You, too, can call on Callite's metallurgical knowledge and precision production for help in the selection of proper wires for any application. Callite Tungsten Corporation, 572 Thirty-ninth Street, Union City, N. J. Branches: Chicago, Cleveland.



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CALLITE WIRE

A FINE WIRE FOR EVERY NEED

DIAMOND WIRE DRAWING DIES

Fort Wayne Wire Die Co., is housed in a new and up-to-date plant with every modern facility for producing dies under working conditions that make for quality. Although larger quarters were built last year, we have had to expand further to keep pace with the demands for more of these excellent dies.

The name "Fort Wayne" stands for the finest in quality and craftsmanship. Our customers can expect courteous and co-operative service on every order, and we strive to make each die so well that it will merit your good-will.

Range of Sizes: .0006" to .102"

You are invited to consult us on your diamond die problems. Please address inquiries to:

FORT WAYNE WIRE DIE COMPANY

2625 EAST PONTIAC STREET • FORT WAYNE, INDIANA

Telephone: Harrison 4319

Wire Association Convention Highlights

(*Continued from Page 679*)

"Properties and Uses of Vinyl Resins for Wire and Cable"

By George A. Fowles,
Engineer, Plastic Materials Div.,
B. F. Goodrich Co.,
Akron, Ohio.

THIS paper discusses the characteristics, properties and uses of vinyl resins as wire coatings and outlines the future of vinyl resins in the wire and cable field.

✦ ✦ ✦

"Extrusion of Vinyl Compounds in the Wire and Cable Industry"

By H. K. Intemann,
Halowax Products Div. Union Carbide & Carbon Corp.,
New York.

THE author here presents an analysis and study of the latest methods used in applying synthetic compounds to wire by extrusion, together with descriptions and requirements for the equipment necessary to do the job.

✦ ✦ ✦

Two New Medals Announced By Metals Society; Awards to be Made During Chicago Metal Congress

ONE of the highlights of the 25th annual National Metal Congress in Chicago the week of October 18 will be the presentation of two newly-created medals.

✦ ✦ ✦

THE Gold Medal of the American Society for Metals and the A.S.M. Medal for the Advancement of Research will be awarded during the annual dinner of the Society Thursday evening, October 21, at the Palmer House.

✦ ✦ ✦

RECIPIENTS of the two medals will be announced. The Gold Medal will be awarded to one recognized for outstanding metallurgical knowledge who has shown great versatility in the application of science to the metal industry. He will have exhibited

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STANDARD TENSILE STRENGTH
TESTER
FOR LIGHT WIRE

DIAL TYPE
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WITH FIXED
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MAX. CAPACITY 300 LBS.
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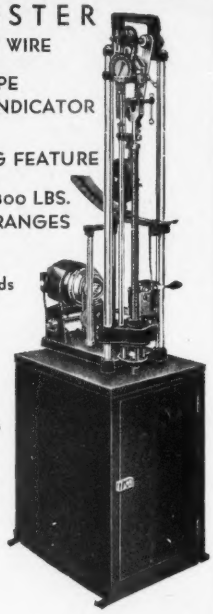

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55 VAN SINDEREN AVE., BROOKLYN, N.Y.

FOR FINE WIRE
NO FINER
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Compounded especially for high-speed machines.

Completely soluble—No fillers—Hence no clogging up of spray jets.

Extremely stable: Uniform, die-saving, trouble-free lubricity at all times.

Economical in use—Efficient in operation.

Apex "SFV" Wire Drawing Compound

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Address inquiries to:

APEX ALKALI
PRODUCTS COMPANY
Main & Rector Sts., Phila. Pa.

exceptional ability in the diagnosis and solution of diversified metallurgical problems relating to different fields of metallurgy of one metal or individual fields applied to several metals. This award will comprise a gold medal, certificate and citation, and will be given only as often as a candidate of exceptional merit can be recognized.

✦ ✦ ✦

THE recipient of the Research Medal will be an executive in an industrial organization the principal activity of which is the production or the fabrication of metals. He will be one who, over a period of years, has consistently sponsored metallurgical research or development and by his foresight and his influence in making available financial support has helped substantially to advance the arts and sciences relating to metals. This award will consist of a medal, plaque and citation.

✦ ✦ ✦

"PRESENTATION of these two new medals will be made to two outstanding personalities in the metal industry", according to **W. H. Eisenman,** national secretary of the American Society for Metals, who pointed out that the awards were created by the Board of Trustees to focus attention on the important developments that are being made today in the metal industry.

✦ ✦ ✦

Second Army-Navy "E" Award Goes to Macwhyte Company

THE second award is recognition by the Armed Forces for "continued and determined effort and patriotism." It covers the period from the date of the first award (in the case of Macwhyte Wire Rope Company, November 21, 1942) until the time of the second award (in this case August 21, 1943).

✦ ✦ ✦

THE second award consists of an Army-Navy "E" Flag similar to the first one but with the addition of one white star in the red field.

If you MAKE or USE WIRE
YOU NEED ONE OF THE MANY
Porter Cutters

Indispensable in wire mills for sampling large wire.

In almost universal use by wire fabricators for cutting reinforcing fabric, fencing, spring wire, etc.

Useful in any plant—large or small—for all sorts of maintenance and repair work—for cutting bolts, rods, wires, rivets, wire rope, chains, or for splitting deformed or "frozen" nuts.

There is a standard Porter tool for every cutting job up to ¾" annealed bolts or ½" hardened chains. Special cutters designed to fit your industry's needs.

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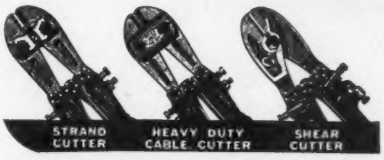

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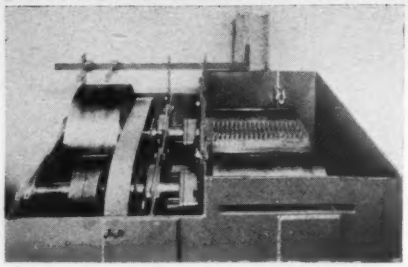

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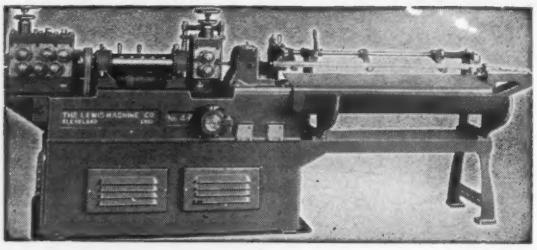

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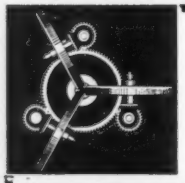

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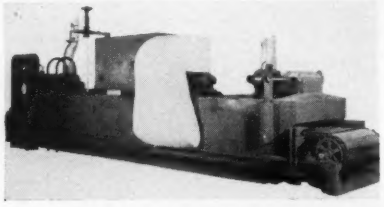
✦ ✦ ✦

IT IS built for temperature range up to 900° F., and maintains absolute temperature uniformity plus or minus 3° throughout the length, width and heighth of the work zone. The same uniformity within the work itself is attained by (1) passing air at extremely high velocities over the work on the conveyor belt, and (2) automatically turning the work as it passes through the furnace. As a result of high air velocity and rapid heat transfer, the load is continuously brought up to temperature in an unusually short time.



THE furnace shown is unloaded by a woman operator. In order to protect her from heat and fumes, ventilation hoods with their own exhaust systems were furnished. In most plants, no operator at all is required, as the furnace is designed for automatic loading and unloading.

✦ ✦ ✦

FUEL consumption is held to a minimum. In actual operation, the cost of fuel proved to be 25 percent lower than originally calculated. Economy of operation results from the efficiently designed air heater, duct and recirculation system. The unit shown is gas fired, but oil or electric heat equipment is available. The working mechanism is built over a heavy, all-welded structural frame to achieve maximum durability.

TODAY, such furnaces are used for drawing, tempering and strain-relieving of various ordnance items, as well as processing of cartridge links, clips and similar parts. They are designed in lower temperature ranges for use as dehydrogenizing ovens, used after pickling. Parkerizing and similar processes. After the war, they can be adapted for a host of peacetime uses.

✦ ✦ ✦

CONTROLS of this Industrial Oven installation are air operated and arranged for extremely accurate regulation of fuel input over a wide work range. Input is automatically proportioned and throttled to handle various production loads, steadily or intermittently. The system is completely protected from pilot, motor, air or current failure by electronic safety controls.

✦ ✦ ✦

FOR further information, write The Industrial Oven Engineering Co., 11621 Detroit Avenue, Cleveland, Ohio.

✦ ✦ ✦

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✦ ✦ ✦

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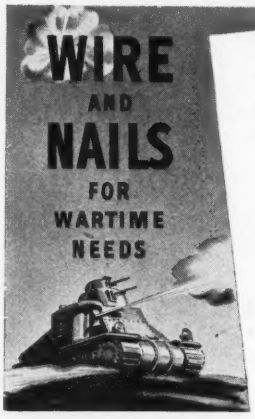

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✦ ✦ ✦

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✦ ✦ ✦

CHEMICAL stoneware has long been the only material of construction which is completely inert to the attack of all acids, alkalies, and solvents (with the exception of hydrofluoric acid and hot caustics). Coupled with its unexcelled resistance to chemical attack has been the ease with which stoneware could be fabricated into equipment of large size and unusual shape. These, plus its low cost and ready availability, have given it high ranking in the chemical field.

✦ ✦ ✦

UNFORTUNATELY, chemical stoneware, besides being somewhat fragile, was never able to withstand any degree of thermal stress. Heating had to be done slowly and carefully, either by the use of hot oil or sand baths, or by jacketing. Heating by direct steam or hot gases was impossible. Cooling was equally precarious. Repeated heating and cooling, no matter how carefully done, progressively weakened the body until structural failure occurred, usually without warning.

✦ ✦ ✦

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✦ ✦ ✦

There are reference tables and a large number of specially drawn illustrations included in this book. An endeavor has been made to leave no phase of the subject untouched.

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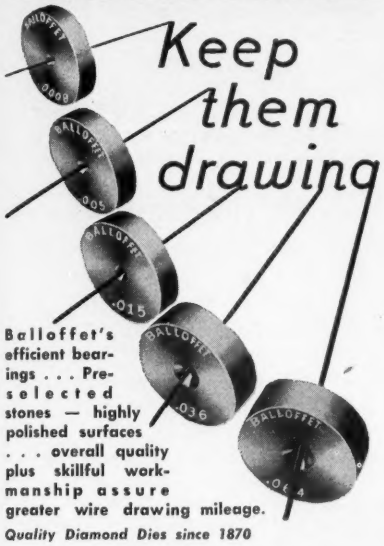

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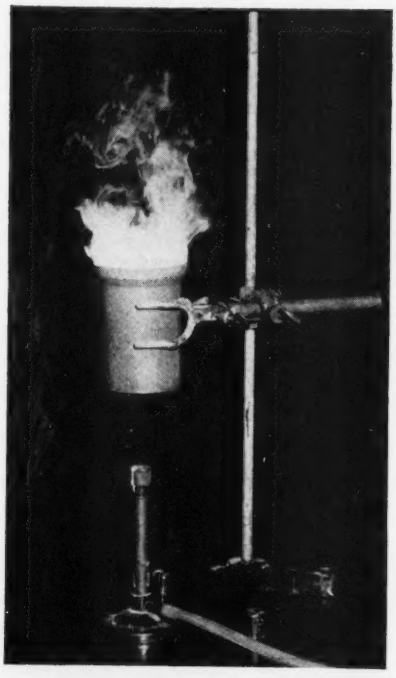
✦ ✦ ✦

"CERATHERM 500" is now in large scale production on such items as tanks, crocks, boiling kettles, mixing kettles, cooling and condensing coils, evaporating dishes, pumps, sinks, pipe, etc. Its cost is only a matter of pennies over that of standard bodies. The materials used are all non-critical, and priorities are not necessarily a pre-requisite to obtain "Ceratherm 500".



In laboratory tests, sample beakers made from "Ceratherm 500", U. S. Stoneware's new heat-shock resistant chemical stoneware, withstood heating by direct flame without breaking. ✦

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(*Continued from Page 674*)

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✦ ✦ ✦

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✦ ✦ ✦

SHOULD any of our readers have additional ideas on this problem that may be of value to this member, or to others, you are invited to submit this information.

✦ ✦ ✦

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PRIMARY chromium chemicals were placed under allocation control by the War Production Board through issuance of Supplementary Order M-18-b as amended. These chemicals are used in tanning, pigment manufacture, chromic acid manufacture surface treatment of metals, chromium plating, textile processing, chemical and dye manufacture and for metal alloys.

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Apco Mossberg Co., Attleboro, Mass.
Carter, B. & F., & Co., Ltd., Bolton, England.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

CEMENTS—Acid Proof
Sauereisen Cements Co., Pittsburgh, Pa.
U. S. Stoneware Co., Akron, Ohio.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Haveg Corporation, Newark, Del.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corporation, Buffalo, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

COILS—Steam
Heil Engineering Co., Cleveland, Ohio.

COLD HEADERS—
Ajax Manufacturing Co., Cleveland, Ohio
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CONTROLS—Heat Treating
Niagara Blower Co., Buffalo, N. Y.

CONTROLS—Temperature
Niagara Blower Co., Buffalo, N. Y.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

COPPER BILLETS—
American Metals Co., Ltd., New York, N. Y.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Callite Tungsten Corp., Union City, N. J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.

DIAMOND POWDERS—
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIE MAKING MACHINERY — For Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.
Wopis Industry Laboratory, Brooklyn, N. Y.

DIRECT ELECTRIC RESISTANCE —Heating
Trauwood Engineering Co., Cleveland, Ohio.

WHERE TO BUY, Continued

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING EQUIPMENT—
Niagara Blower Co., Buffalo, N. Y.
Ross, J. O., Engr. Co., New York, N. Y.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Industrial Cooling
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FABRIC MARKER TAPE—Cable Identification
Marker Tape Corp., New York, N. Y.

FLASH BAKER—
Morrison Engr. Corp., Cleveland, Ohio.

FLUX—Galvanizing
Dewey & Almy Chemical Co., Cambridge, Mass.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

FURNACES—Annealing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio.

FURNACES—Hardening & Tempering
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Robertson, John, Co., Brooklyn, N. Y.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Non-Oxidizing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Normalizing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Pot (Oil, Gas and Electric)
Holden, A. F., Co., New Haven, Conn.

FURNACES—Salt Bath
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Meaker Co., The, Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING FLUX—
Dewey & Almy Chemical Co., Cambridge, Mass.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

IDENTIFICATION TAPE—
Marker Tape Corp., New York, N. Y.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.

JETS—Steam
Heil Engineering Co., Cleveland, Ohio.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Bellefonte, Pa.

LIQUID FOAM BLANKET—
Dewey & Almy Chemical Co., Cambridge, Mass.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
National Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Root, B. M., Co., York, Pa.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading with Wire Drawing Attachment
Ajax Manufacturing Co., The, Cleveland, O.

WHERE TO BUY, Continued

MACHINERY—Copper Wire Drawing and Rolling
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., The, Cleveland, O.
Broden Construction Co., Cleveland, Ohio
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Ajax Manufacturing Co., The, Cleveland, O.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
National Erie Corp., Erie, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Thropp, Wm. R., & Sons Co., Trenton, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Hydraulic Testing
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
National Wire Machy. Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
National Erie Corp., Erie, Pa.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Working, Mills, Calendars, etc.
Thropp, Wm. R., & Sons Co., Trenton, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
Hydrawmatic Machine Co., New York, N. Y.
Marshall Richards Machine Co., Ltd., Gainsborough, England.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., The, Cleveland, O.
Broden Construction Co., Cleveland, Ohio
Hallden Machine Co., The, Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Mfg. Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

WHERE TO BUY, Continued

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Amthor Testing Instrument Co., Brooklyn, N. Y.
Riehle Testing Machine Div., of American Machines & Metals, Inc., East Moline, Ill.
Robinson Mfg. Co., Muncy, Pa.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
National Wire Machinery Co., Lynn, Mass.
Shuster, F. B., Co., New Haven, Conn.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Hydrawmatic Machine Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
National Wire Machinery Co., Lynn, Mass.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MARKER TAPE—Cable Identification
Marker Tape Corp., New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PATENT INFORMATION SERVICE—
Manufacturers World Patent Information Service, Brooklyn, N. Y.

PICKLING COILS AND JETS——Steam
Heil Engineering Co., Cleveland, Ohio.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Keagler Brick Co., Steubenvilla, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
Knight, Maurice A., Akron, Ohio.
U. S. Stoneware Co., Akron, Ohio.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

QUENCHING BATH CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

WHERE TO BUY, Continued

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Spencer Steel Co., New York, N. Y.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Heil Engineering Co., Cleveland, Ohio.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STEAM COILS & JETS—For Acid Tanks
Heil Engineering Co., Cleveland, Ohio.

STONEWARE—Chemical
U. S. Stoneware Co., Akron, Ohio.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., The, Fostoria, O.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Keagler Brick Co., Steubenville, Ohio.
Knight, Maurice A., Akron, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Knight, Maurice A., Akron, Ohio.
Nukem Products Corporation, Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TAPE—Marker for Cable Identification
Marker Tape Co., New York, N. Y.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Amthor Testing Instrument Co., Brooklyn, N. Y.
Riehle Testing Machine Div. of American Machine & Metals, Inc., East Moline, Ill.
Scott, Henry L., Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VULCANIZERS—
Knight, Maurice A., Akron, Ohio.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wheeling Steel Corp., Wheeling, W. Va.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union, City, N. J.
Hudson Wire Co., Ossining, N. Y.
Seneca Wire & Mfg. Co., Fostoria, Ohio.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio.
Spencer Wire Co., Spencer, Mass.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Bros., Inc., Cortland, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Harris, F. A., Inc., Springfield, Mass.
Jersey Steel & Wire Corp., Irvington, N. J.
Johnson Steel & Wire Co., Worcester, Mass.
Seneca Wire & Mfg. Co., Fostoria, Ohio.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Harris, F. A., Inc., Springfield, Mass.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Harris, F. A., Inc., Springfield, Mass.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Harris, F. A., Inc., Springfield, Mass.
Spencer Wire Co., Spencer, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.
Spencer Wire Co., Spencer, Mass.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Bros., Inc., Cortland, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

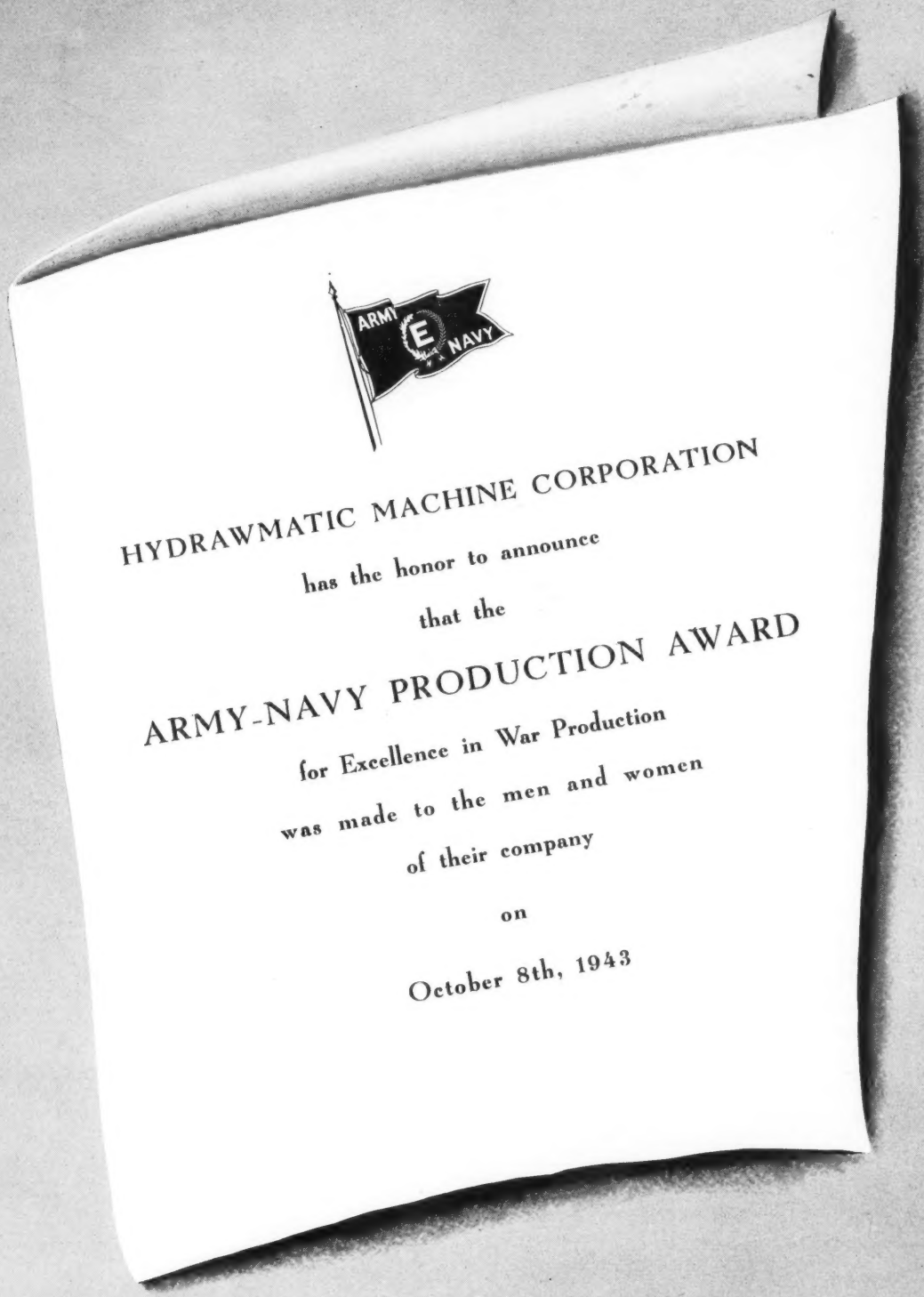
WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WIRE WINDER—
Standard Mill Supply Co., Providence, R. I.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.



HYDRAWMATIC MACHINE CORPORATION

has the honor to announce

that the

ARMY-NAVY PRODUCTION AWARD

for Excellence in War Production

was made to the men and women

of their company

on

October 8th, 1943

HYDRAWMATIC MACHINE CORPORATION

408 Concord Avenue, New York 54, N. Y.

Builders of hydraulically driven back-pull wire drawing machines and spoolers

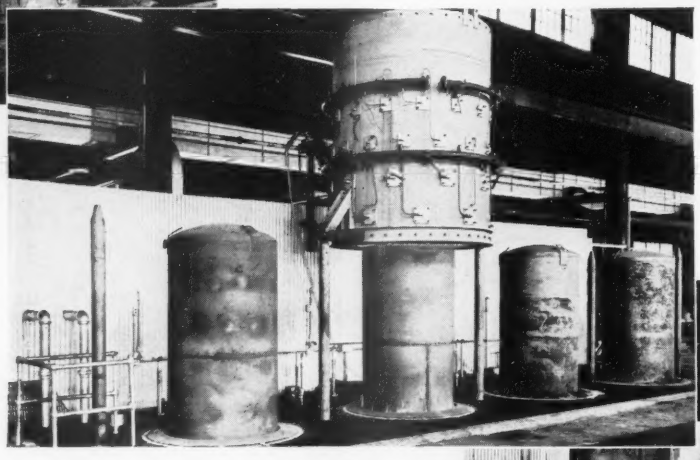
EF Gas Fired Bell Type Furnaces

Maintain Uniform Temperature Throughout Charge

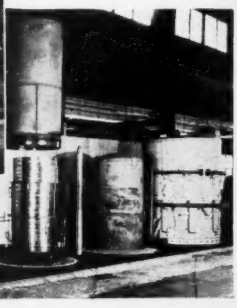
Regardless of the

Weight, Size or Height of Load

(Above) An EF Bell Type Installation consisting of furnace, 4 bases, and retorts.



(Left) Each base accommodates charges up to 22,000 lbs. and coils up to 45" in diameter.



(Right) Removing a retort from base, showing bright annealed charge.

For Annealing Strip, Wire and Other Products

Equipped with special radiant type gas burners and separate automatic temperature control zones, these **EF** gas fired removable hood type furnaces obtain and maintain uniform temperature distribution throughout the entire charge on each and every load, regardless of weight, size or height of load.

The installation shown above was designed for annealing medium and high carbon mirror-finish cold rolled steel strip, and is equipped with special **EF** gas generator equipment for producing the protective atmosphere for bright annealing without decarburization. Each base accommodates charges up to 22,000 lbs. and handles coils in any width and up to 45" in diameter.

This installation is equipped with a pre-mix plant for mixing the gas and air in proper proportions. This eliminates all manual burner adjustments, as the gas-air mixture is previously obtained in the machine. The high turn down ratio on burners permits use of modulating type control.

This equipment is provided with 4 bases, each with motor driven centrifugal type fan for circulating atmosphere down through the center of the charge and up between the outside of coil and the gas-tight retorts.

An extremely high rate of circulation is obtained and uniform temperature is provided and maintained regardless of the size of charge. Additional information on the above or on any other type furnace will be gladly furnished on request.

Recent outstanding production furnace installations include furnaces for bright annealing both ferrous and non-ferrous strip, wire, tubing and other products . . . furnaces for the production heat treatment of tank armor castings, cartridge cases, shell forgings, bomb and gun parts, machine gun cartridge clips, aircraft and aircraft engine parts, aluminum and magnesium castings, bolts, springs, and many other allied products.

We specialize in designing and building production furnaces.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production